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The PRACTICAL ENGINEER

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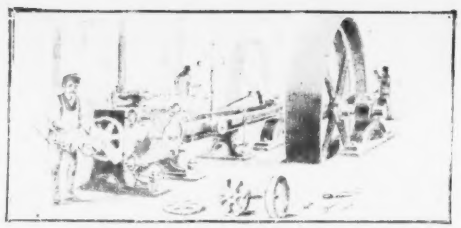

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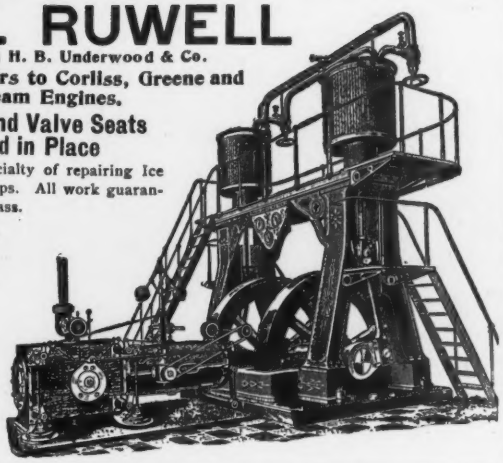

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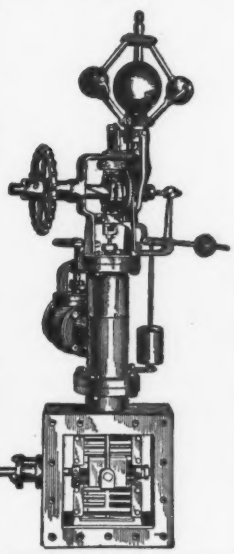

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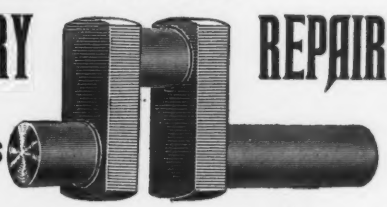

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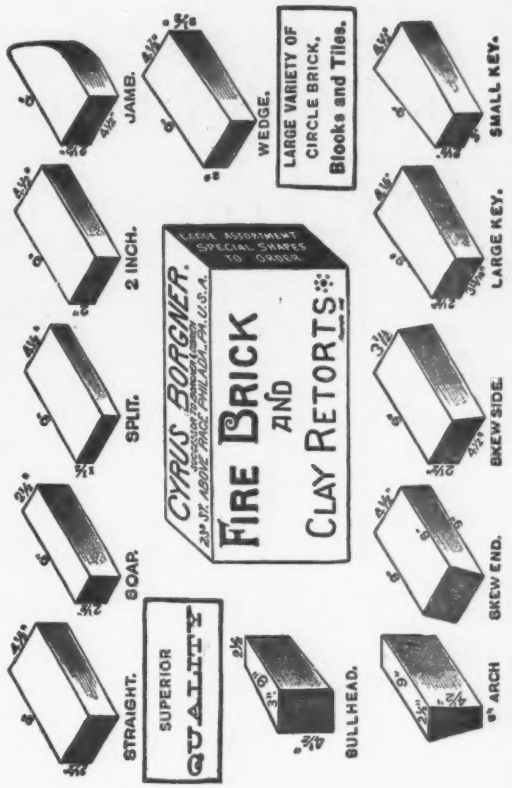

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Cylinders and Valve Ports of engines and pumps of all makes and sizes rebored, and flat valve seats refaced without removing them from their present positions. All kinds of heavy machine work done at short notice. Pipe cut from ¼ in. to 6 in. diameter.

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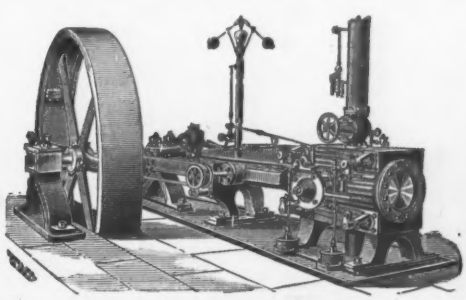

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ESCANABA, MICH.,
Sept., 16, 1901.
THE PEERLESS RUBBER MFG. CO.,
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SIRS:—I wish to give you my testimonial in regard to Peerless Piston and Valve Rod Packing. Have used it for the past twelve years and put it to some severe tests.

While in charge of the Escanaba & Gladstone Transportation Co.'s Steamer "Lotus," which has a compound engine and steam at 140 lbs., we ran 22,000 miles on a single packing.

Congratulating you on the success of the same, and assuring you that I shall always recommend it when I possibly can, I remain,

Yours truly,
ALFRED LARSON,
Chief Engineer, Escanaba Water Works

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CAUTION:—A Facsimile of this Label is glued around each and every coil of the genuine Peerless Piston and Valve Rod Packing

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Celebrated "Rainbow Packing," "Peerless Piston and Valve Rod Packing," "Eclipse Sectional Rainbow Gasket," "Hercules Combination," "Honest John," "Zero," "Success," "Arctic" and "Germane Packings."

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The Practical Engineer

THE
OFFICIAL ORGAN
OF THE
AMERICAN ORDER
OF STEAM ENGINEERS

Devoted to the Interests of Stationary Engineers.

VOL. VI. PHILADELPHIA, JUNE, 1902 No. 5

Governors and "Hunting."

The object of the steam engine governor is to keep the engine at an approximately constant speed. This it may do in either of two ways. First, it may alter the pressure of the entering steam so as to maintain a mean effective pressure proportional to the load. Or second, it may change the point of cut-off, also causing a variation in the mean effective pressure which shall make the latter correspond to the resistance.

No governor, however, can give an absolutely constant rate of rotation. For there must be some change in the speed before the governing mechanism can act to bring the engine back to the original desired speed.

Let us take the case of an engine running in a power plant. In no case can the load be absolutely uniform. Suppose that the engine is running at the desired speed under a given load, and that an additional load is suddenly thrown on, as might be the case if a line of shafting or a machine were put into motion through the agency of a friction clutch.

The resistance at once becomes greater than the work which the engine is doing, and the result is that there is a slowing down of the speed of the engine. But this change in speed at once affects the rate of revolution of the governor and it slows down also. The consequence is that the steam valve is opened wider, if it is a throttling governor, or the point of cut-off is made later, if it is a variable cut-off engine. And this change causing an increase in the mean effective pressure, the engine comes up to normal speed. The reverse operation would have taken place had the load been suddenly decreased, as by throwing off a portion of the load.

A good governing mechanism is one which will respond promptly to any tendency toward variation in speed, and for this reason it must be sensitive to a certain degree. There is, however, a limit to this property, and a governor can be too sensitive, or over-sensitive. When a governor is over-sensitive it induces in the running of the engine what is known as hunting.

An explanation of just why this is so involves several reasons, all of which contribute toward causing that rapid variation between limits of speed, now faster, now slower, than the proper speed, which is commonly termed hunting. As shown in the example in a preceding paragraph, the governing mechanism cannot respond instantly to a change in speed. And in contrast to this, when the governor does begin to change its position, the engine cannot immediately conform to the new conditions. This is because of the energy stored in the moving parts of the engine and also because of the heat energy of the steam in the steam chest or in the cylinder. For if the governor is of the throttling type, there is still steam in the valve chest after the governor has acted, which is capable of doing work. And if the point of cut-off is passed, with a variable cut-off gear, the steam in the cylinder does its work irrespective of the regulator, and no regulation can really take place until the next stroke.

As an example of hunting caused by a too sensitive governing mechanism, let us suppose a case in which an engine running under a given load has that load suddenly decreased. The fly-wheel speeds up to a certain extent before the governor acts. Then the balls of the governor fly out and the steam is either throttled or cut off earlier. But instead of regulating to the proper point, the pressure is reduced too greatly in the cylinder and the resistance becomes larger than the force applied. The consequence is that there is a sudden tendency to reduce the speed. As soon as the governor feels this reduction, the balls drop again. But they drop too far, and cause too great a pressure in the cylinder, again speeding up the engine. And so this action continues, with alternate slowing and increasing of speed, the governor vainly trying to bring the

resistance and the force applied into a state of equilibrium, and the engine, so to speak, hunting its normal speed.

There is another likely cause for this same trouble. It is the presence of excessive friction in the working parts of the governing apparatus. In such a case the friction prevents any change of position of the governor until the speed of the main shaft has altered perceptibly, and as a consequence when the governor does act, it gives over-adjustment, so to speak, and produces an equally troublesome state of affairs at the other extreme.

The use of dashpots on, or attached rigidly to, the spindle of the governor, is for the purpose of steadying the action of the device. In many cases the balls have considerable weight, and if a change in speed occurs, the inertia of these masses and the momentum obtained carry them beyond the point to which they should swing, and hunting results. This difficulty is overcome by the use of the dashpot, as it offers a slight resistance to any very sudden change in height of the governor and so aids in bringing the balls quickly into the proper plane of rotation.

+ + +

Importance of the Pipe Covering Question.

This subject relates to the radiation of heat. The importance of a protection of exposed surfaces from radiation of heat or cold is now undisputed, and many experiments have been made to determine the relative value of the various non-conducting substances. This point determined, then it only becomes a question, presumably, of looking over the list of competitive tests and selecting that showing the best results. But therein you may make a great mistake, many of the tests upon the face of things in general, make a splendid showing, yet upon being put into actual use they may not live up to the standard shown in the original test.

An instance of this sort may be seen from the following abstract, taken from circular No. 65, Boston Manufacturers Mutual Fire Insurance Co., which was issued following a test made for them of various coverings. "The question of the ability of the various materials to resist the action of heat for a length of time is of great importance, as is also the question of the effects of vibration and jarring. These matters are to be investigated at once, though the possibility of any of these materials being injured by jarring is very small. None of the specimens were affected disastrously by the heat of the tests except the 'Asbestos Sponge' in which the sponge is completely charred for a distance of three-eights of an inch from the pipe, after an exposure of six hours."

An examination of most any of the test tables of pipe coverings will show that Asbestos Sponge covering effects a fairly high percentage of deflected radiation, yet the above quotation would imply that an application of such covering would be dear at any price, disintegration taking place so rapidly.

This is one feature that the buyer must beware of, but there is another much more subtle which must be considered when attaching coverings for this purpose, for instance, a concern will take advantage of the high showing made in the tests to ensure a sale; you might be afraid of its lasting qualities and ask a trial on that line; they will agree to your proposition at once and will likely show that their covering will not deteriorate seriously, but, is it Asbestos Sponge Felted covering such as was used in the tests, or is it a much less effective article in the nature of loss through radiation, though lasting in the matter of heat affection? In either case the purchaser is a loser; hence it is well to be not only sure that the article is what it is represented to be, but also that it is a staple product of lasting effect.

Again it is well to study the climatic conditions with which your coverings will have to contend; you must remember it is possible that all the parts of your plant may not be under steam all of the time, hence you must look well into the effect produced in such cases.

Weight, too, is a feature to be well considered, the strain upon pipes from some coverings now upon the market is such as to produce on long lines leaky joints and kindred annoyances. All insulation of this kind resolves itself finally into a question as to which will be the most permanent and efficient under all conditions, and not that which makes the greatest average in a test of a few hours duration.

Elsewhere in this edition we publish an article showing the results of test made with cork as a covering. The results obtained, while gratifying to the manufacturers of this style of covering, are not nearly so commendatory as is the consensus of a report on tests of the durability of cork as a covering made by Professor C. L. Norton, Massachusetts Institute of Technology, Rogers Labratory of Physics. A part of Mr. Norton's report follows:

"I have made an investigation of the conditions of installations of cork as a steam pipe cover. The Nonpareil Cork Manufacturing Co. has placed a list of its sales at my disposal, and I have investigated what I believe to be the worst or most marked cases of failure, being guided somewhat by the energetic agents of other manufacturers of steam pipe coverings.

"As a result I find that all charges against Cork steam pipe cover on the ground of ignition or charring, or disintegration, are unfounded, and that the statements which I have made classing it with others as a suitable material for covering steam pipes are borne out by the facts. In no case where the cover has been properly or even reasonably well cared for, is there any indication of the failure of the Nonpareil Cork."

From this it would seem that the possibilities of cork as a covering are very alluring, combining as it does extreme lightness with a high average in the radiation tests, and great durability.

Supreme Council Convention American Order Steam Engineers

The Sixteenth Annual Convention of the Supreme Council American Order of Steam Engineers, which was held at Reading, Pa., May 12th, 13th and 14th, was a success in the highest sense, a tribute to the principles of the Order, and a credit to the profession of stationary steam engineering.

The officers and delegates began to arrive at Reading on Saturday preceding the Convention and every train on Sunday brought additional recruits with the result that by ten o'clock Monday morning, the hour set for the Supreme Council to convene, nearly all were there to answer the roll call, and the few tardy ones all put in an appearance during the day.

The local executive committee had men at every train to meet the incoming delegates and each one was immediately decorated with one of the handsome souvenir badges which the Committee had prepared for the occasion. These badges were composed of a decorated silver bar inscribed with the word "Souvenir," from which was suspended a celluloid oval badge, with the inscription "Sixteenth National Convention, Reading, Pa., 1902," encircling the emblem of the Order, the ribbon used for suspending this from the bar was of black and yellow, the colors of the Order.

The Monday morning session was necessarily brief and was devoted to the opening exercises, the examination of credentials and the appointment of Committees. After the formal opening, at which the usual ritual was conducted by the officers, a recess was declared, and Mayor Yeager, of the City of Reading, was introduced by Supreme Chief, C. P. Williams. Mayor Yeager delivered a most admirable and exceedingly hospitable address, welcoming the delegates to the city. Mr. Yeager expressed great pleasure in having an opportunity of welcoming so representative a body of men to Reading. He expressed hearty sympathy with the principles of the Order, upon which subject he appeared to be well informed. The Mayor praised the organization for securing the mutual advancement and individual improvement of its members and stated that they deserved the highest esteem of every American citizen. He paid a high tribute to the character of the men in the Order, stating that he personally knew of the good work they had done for their fellow members in Reading. He praised the fraternal side of the Order and declared that theirs was a standing example to all organizations. He expressed the hope that the Order might continue and flourish for many years, and in closing he extended them the right hand of goodfellowship and said that he was glad to extend to each one present the latch key of the City.

OFFICERS AND DELEGATES AT SIXTEENTH ANNUAL CONVENTION, AMERICAN ORDER STEAM ENGINEERS, READING, PA.

The response was made by Supreme Chief Engineer Williams, who said in part: "It is gratifying to receive a welcome such as we have just heard, especially when such welcome comes from one held so high in the esteem of his fellow citizens, and I trust that your expressions of friendship will be followed by our hearty appreciation of the good things which

our Reading friends have provided for us. Our Organization is growing in membership and influence for good, and with our unprecedented prospects for the future we may well be proud of our membership in it."

Mr. Williams thanked his honor again and invited him to inspect the exhibits of the manufacturers on the floor below before leaving, which he did with the result, we are told, that the first man inside the door got an order from him.

CLIFFORD P. WILLIAMS, SUPREME CHIEF ENGINEER.

The following Committees were named for the Convention:

Credentials—John T. Dodge, H. L. Magee and William Mitchell.

Laws—H. L. Magee, James Sweares, F. R. Moore.

Finance—W. S. Price, A. P. Driesbach and H. Taelliaferra.

Good of the Order—Noah Pierson, L. J. Calloway, John T. Dodge.

Mileage—Wm. Mitchell, James H. Stallings, R. Peterson.

Written Work—A. M. Plummer, William J. Eccles, A. P. Driesbach.

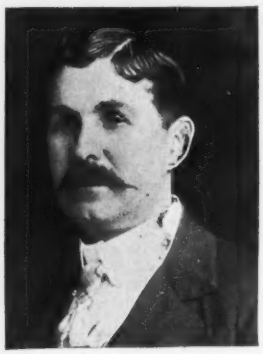
Unwritten Work—J. T. Harris, William J. Beatty, A. J. Dridrich.

Printing—D. J. Stayton, Jos. L. High and Charles Stremmy.

After a recess for dinner the Convention went into executive session at 3 P. M. and continued behind closed doors until 5.30.

Monday evening the local Executive Committee gave a reception to the manufacturers and the public of Reading for the purpose of inspecting the machinery and engineers' supplies exhibited on the ground floor of the Convention building. The display was excellent and the building was thronged to its full capacity throughout the evening.

Tuesday morning the Convention went into session at 9.30 sharp, and continued their labors without cessation until 12.30 when they adjourned for the day. This session was devoted largely to the election of officers which resulted as follows: Supreme Chief Engineer, Clifford P. Williams, Philadelphia; Supreme First Assistant, Noah A. Pierson, Baltimore; Supreme Recording Engineer, J. H. Stallings, Baltimore; Supreme Corresponding Engineer, J. C. McDowell, 1913 S. 8th Street, Philadelphia; Supreme Treasurer, George W. Richardson, Philadelphia; Supreme Chaplain, John T. Dodge, Boston, Mass.; Supreme Senior Master Mechanic, W. S. Price, Atlantic City, N. J.; Supreme Junior Master Mechanic, Jos. T. Harris, Milwaukee, Wis.; Supreme Inside Sentinel, D. J. Stayton, Wilmington, Del.; Supreme Outside Sentinel, Harry L. McGee, Baltimore, Md.; Trustee for three years, Wm. J. Mitchell, Wilmington, Del.



GEO. W. RICHARDSON, SUPREME TREASURER.

After dinner the delegates all assembled at the American House and took specially chartered cars for the mountains. The trip over Neversink Mountain was made first and the entrancing scenery from its sides and summit were viewed with wonder and admiration. The great mounds of slag, hundreds of feet high and covering untold acres with the dense clouds of black smoke arising, which were passed as the cars ascended the mountain were frequently compared to the volcanic disturbances in the West Indies, and the beautiful view from Point Lookout on the summit, where the eye can roam for twenty miles over one of the most fertile and beautiful valleys in the world, is a sight not soon to be forgotten. Returning from Neversink, a trip over old Mt. Penn immediately overlooking the City was immediately begun.

W. S. PRICE, SUPREME SENIOR MASTER MECHANIC.

The trip to the summit of Mt. Penn was made with a locomotive specially built for mountain climbing, but owing to the heavy load and the fact that it was the engineers' first trip this season, several brief stops were necessary, and during these intervals the engineer and fireman in charge were given enough gratuitous advice to last them for the balance of their natural lives. Someone suggested that they use Vim cylinder oils, another gave them a sample of Keystone Grease, another recommended Jenkins' Valves, and they were given samples of Garlock, Eureka, Smith's Expansion and forty other brands of packing, but their stock of good nature was inexhaustable, and when the summit was reached all were in the best of spirits. A half hours' stop was made at the Summit House, from which point the view of the city beneath and the

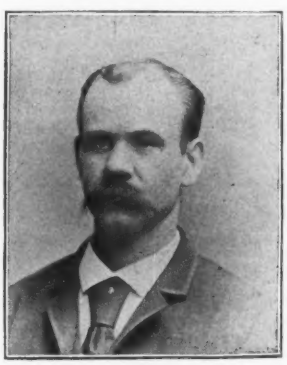
J. H. STALLINGS, SUPREME RECORDING ENGINEER.

hills surrounding is undescribably beautiful. From this point the return trip was made over the famous Mt. Penn gravity road. The cars run over this road by gravity at a nerve racking speed for a distance of nine miles, coming to a stop at the foot of the mountain right at the city's edge. This ride was exhilirating in the extreme and every one seemed to enjoy it immensely; but, although the day was warm, many of those who were without overcoats were glad when they reached the bottom.

FRANKLIN R. MOORE,
SUPREME TRUSTEE.

Returning to the hotels the delegates made preparations for the annual banquet in the evening, which was one of the principle features of the Convention.

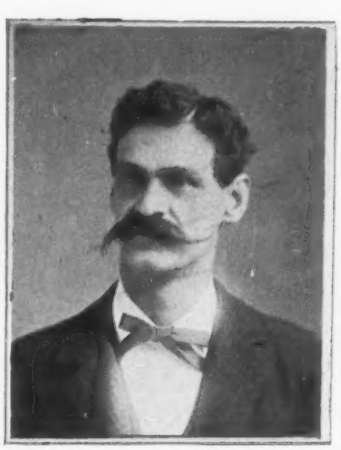
The banquet was held in the Convention Hall and was announced promptly at 9 P. M.; 200 guests were seated. The tables presented a most attractive appearance, being decorated with many plants and fragrant flowers. The menu was excellent.



H. L. MCGEE,
SUPREME OUTSIDE SENTINEL.

J. C. MCDOWELL,
SUPREME CORRESPONDING ENGINEER.

Grand Chief Hiram M. Trout, who was also Chairman of the Executive Committee, made an admirable toastmaster. The first speaker was city solicitor of Reading, Walter S. Young, speaking for the "City of Reading." Mr. Young spoke of the beauties of the city and the hospitality of its people. He paid a compliment to the members of Progress Council of Reading, stating that he had enjoyed the personal acquaintance of most of them. He referred to them as their local captains of industry. The next speaker was Judge H. Willis Bland, who spoke on "The American Engineer." He said in opening that if he had not been a lawyer he might have been an engineer, as he had left a Philadelphia machine shop to study law when he came to Reading. He declared that it was important that the engineer should be a man who knew his profession thoroughly, and spoke of the efficiency of the American mechanic of this class. He referred to the many inventions of the engineer—the inventions coming from the engine rooms and work-shops as well as the labratory and class room.



A. M. PLUMMER, SUPREME TRUSTEE.

W. J. MITCHELL,
SUPREME TRUSTEE.

John H. Seibert spoke for the manufacturers of Reading who were assisting the engineers in entertaining the visitors. Mr. Seibert referred to his membership in the Order and said that he was very proud of his connection, as well as of the objects and achievements of the Order. He said that not only in Reading but everywhere else the Order had the sympathy and co-operation of the manufacturers in its good work. Mr. John D. Missimer, Editor of the Reading Eagle, spoke for the press, and amused his audience with a pleasing story of his youthful desire to be a stationary engineer like his Uncle Bill, who ran a 40-horse slide valve in an old mill.

JOSEPH T. HARRIS,
SUPREME JUNIOR MASTER MECHANICS.

At this juncture a pleasant incident occurred when Supreme Chief Williams presented Albert Keppleman with a handsome boquet of American Beauty roses on behalf of the officers and delegates in acknowledgement of his cease-

less efforts in entertaining the visitors. Mr. Keppleman, who was Secretary of the Executive Committee, was an untiring worker throughout the entire session. He was here, there and everywhere all the time, and always with the one desire of making things comfortable and pleasant for all. Supreme First Assistant Noah A. Pierson, following the Supreme Chief, presented Mr. Keppleman with still another token of regard in the shape of a new Willis Planimeter. Mr. Keppleman was greatly surprised but expressed his appreciation in a few brief words.

D. J. STAYTON, INSIDE SENTINEL.

Mr. Chas. E. Carpenter, General Manager of the firm of E. F. Houghton & Co., Philadelphia, was the next speaker and with his characteristic force and sound logic soon had the undivided attention of his hearers. He described the great advantages of perfect organization and urged the members to confine their work at all times to within the lines and the laws of their Order. He was roundly applauded. Jerry Leahy, Jr., of Perth Amboy, N. J., the oldest past Supreme Chief in the Order, also spoke telling of the good old days when the Order was in its infancy. Toastmaster Trout then thanked the guests and wished them good night, while the orchestra played "Home, Sweet Home."

JOHN T. DODGE, SUPREME CHAPLAIN.

Wednesday morning the Convention went into session early, taking a recess for dinner and returning immediately to their labors. At 5 P. M. the Convention adjourned finally to meet again at the call of the Chair one year hence.

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The Exhibition of Supplies.

An unusual but pleasing feature of the Annual Convention of the American Order of Steam Engineers at Reading was the very creditable exhibition of steam appliances and engineers' supplies which was held on the ground floor of the Convention building. This was the first attempt at anything of this character and the result was extremely gratifying, for while it was by no means a large exhibition, it was more than was anticipated, and the great variety of appliances and devices shown made it a matter of much interest to the delegates, and gave the entire Convention a more business-like air than has been noticeable at previous Conventions.

There were 26 separate exhibits, comprising almost everything from grate bars to steam engines ready for the foundation. Every available foot of space in the main exhibition hall was occupied, and two tardy applicants had to be content with small corners in an adjoining room. The fact of the exhibit being in the same building where the Convention was held was a decided advantage to all concerned. The Convention was held in the second floor and exhibition of supplies on the first, so that the delegates, when entering or leaving the building, almost invariably strolled around among the exhibits for a few minutes. In one corner of the exhibition hall Professor Edward E. Barr kept a piano going almost constantly, and the excellence of his performing was frequently and favorably commented upon. At times Secretary Al. Keppleman or Charles Robson, of grate bar fame, found time to accompany him with the violin, and not infrequently a chorus of singers, composed of the exhibitors or visitors, would join in and assist with their voices in entertaining the multitudes. A large reception-room to the right of the entrance to the hall served as an office for the executive committee, around which was displayed many of the models and other devices used in their instruction work by Progress Council, all of which was attractively decorated with flags and bunting. A register was kept at this office, in which each visitor was requested to sign his name. In another corner of this room was located a neatly-arranged cigar-stand presided over by a very courteous young man. Further to the right was still another room smaller in size but equally popular, for the reason that it contained at all times a well-stocked buffet. During the evenings, at noontimes, and recess these rooms and the entrances were always well filled, but while the Convention was in session the crowd was composed principally of supply-men, and they made a merry throng. Practical jokes and tricks of all kinds were in order and were worked to the limit; but the boys were good-natured throughout and all enjoyed themselves thoroughly.

Many of the exhibits were quite elaborate, as may be seen by the illustrations on the front cover of this issue, and the delegates showed their appreciation of the souvenir samples and advertising matter which was freely distributed. The exhibit of Bright & Co., of Reading, which included a large stock of Smith's "Automatic Expansion" and Flax packings, together with a complete line of Lunkenheimer valves and

lubricators, Heintz Traps, oil cans of every description, belting, etc., was probably the most extensive. This exhibit was looked after by Mr. H. M. Ermentrout, one of Reading's brightest salesmen.

Adjoining this on the one side was the handsome exhibit of White Star Oil Filters by the Pittsburg Gage & Supply Co., which was in charge of Mr. G. Frank Duemler, their popular Philadelphia representative. On the other side was the neat exhibit of Ellis & Cummings, lubricating oil dealers of Reading. Just across the isle, in one of the four large spaces occupying the centre of the hall, was a very handsome exhibit of lubricating oils by E. F. Houghton & Co. This exhibit was an ornament rather than an advertisement, and probably attracted more favorable attention than any other. It was looked after by Mr. F. R. Moore, who gave out scores of sample boxes of Houghton's famous cosmoline and cans of Houghton's belt dressing as souvenirs. Beside this was a neat exhibit by the Greth Machine Works of Reading, in charge of Howard Wisler, gigantic in both voice and stature but withal a good fellow, who was in constant demand on all sides. Here also was to be found a most handsome display of "Eureka" Packing of all sizes, scores of boxes of it, and all studded with the little red diamond labels. It made a pretty sight and brought forth many complimentary expressions from the delegates.

Improved Robertson Thompson Indicators, Victor Reducing Wheels, and Willis Planimeters were also much in evidence, and Mr. Thomas C. Keogh was always the centre of an interested crowd as he gave instructive and entertaining demonstrations in their use. Adjoining this exhibit to the rear was the most complete line of steam appliances exhibited—that of the Sims Company of Erie. This exhibit included separators, boiler feeders, oil filters, oil cups, feed-water heaters, and the Sims low-water alarm, all looked after by Mr. Sims himself, whose superior mechanical knowledge drew around him many of the best men present. Next to this was the union-made overall exhibit of H. S. Peters, of Dover, N. J., including every style of overalls made, the best on earth, and in charge of one of the best of good fellows, Mr. Frank G. Cook. Just across the isle from this Mr. John Seibert had an attractive exhibit, including a vertical engine, Patterson damper regulators, wicks, safety columns, etc.

To simply say that George W. Lord, the boiler compound manufacturer, had an exhibit would be incomplete; to say that his representatives had the town would be more accurate. Every available foot of space, every post or vacant spot, was covered with attractive advertising literature, while genial Captain Doughty, who is a favorite with every engineer within fifty miles of Philadelphia, and Mr. Edw. McCarthy, the king of boiler compound salesmen, were everywhere all the time, and with their pleasing jollities and inexhaustible good humor added many new ones to their already large number of friends.

The exhibit of the Dearborn Drug & Chemical Works of Chicago was also the centre of much interest, owing to an unusual collection of specimens of boiler scale and the intensely interesting souvenirs which their popular eastern manager, Mr. William B. McVicker, distributed with a lavish hand. Next to this was quite an attractive exhibit by the Fairbanks Company, and next came the elaborate grate-bar exhibit of Charles Robson, of Eighth Street and Washington Avenue, Philadelphia. This exhibit included a full-sized "Ajax" rocking grate set up complete, Herringbone, circular, skeleton bars, the improved Keystone grate, and other types in endless variety, all of which were in charge of Mr. Robson, Jr.

On the other side of the hall came the exhibit of the Garlock Packing Company, including the entire line of packings manufactured by this well-known firm for every known service, in charge of Mr. C. M. Barnes, their popular representative for central Pennsylvania. Mr. L. E. Adams manager of the firm's Philadelphia house, and Mr. W. R. Haggart were also present, and the trio made a strong combination. Immediately adjoining was Jenkins Brothers' handsome exhibit, including a generous display of valves and disks for every variety of service, and thousands of feet of their famous "96" sheet packing. Their interests were looked after by Mr. John Cork, of Philadelphia, and Mr. William G. LeCompte, of Baltimore.

Following came a neat exhibit by Thomas C. Warley & Co., of Philadelphia, and next the exhibit of Lindstrom's steam and oil separators by John T. Lindstrom, of Allentown, Pa. Mr. Lindstrom is an engineer of more than ordinary ability, and he was frequently the central figure of interesting discussions on mechanical subjects. If any exhibit surpassed in point of attractiveness, it was that of the Bashlin Valve Company of Warren, Pa., which occupied the corner position on this side of the building. This exhibit was as complete as could have been desired, and added much to the appearance of the affair. Mr. Bashlin and Mr. G. E. Tanburg, who were in charge, proved excellent demonstrators and made hosts of friends. Beside this came the exhibit of C. J. Rainear & Co., of Philadelphia, and next that of the Collins Manufacturing Company of Conshohocken. Just across the isle on the left of the main entrance Mr. John R. Livezey, of Philadelphia, had a handsome exhibit of Nonpareil Cork-pipe covering, sheet cork for floors, etc , which attracted much attention, and bears the distinction of being the only exhibitor who got an order from the Mayor of the city. Among other exhibitors was the Delaware Electric & Supply Company of Wilmington, represented by Mr. Benjamin T. Gause, who showed an excellent lubricator, which met with much favor; William C. Robinson & Co., lubricating oil manufacturers of Baltimore, who were ably represented by Mr. B. F. Darble; the Cling-Surface Manufacturing Company, belt dressing, and William B. Severn, manufacturer of liquid anhydrous ammonia.

All of the exhibitors expressed themselves as being well pleased with the affair, and particularly with the treatment accorded them by the Committee in charge. A pleasant episode occurred on the last day, when the exhibitors joined in raising a purse, with which a handsome ring was purchased and presented to Al. Keppleman, Secretary of the Committee, and a Morris chair for Chairman Trout as a token of their appreciation. Mr. LeCompte presented the ring and Mr. Barnes the chair. Both Mr. Keppleman and Mr. Trout assured their guests that their presence and good behavior was ample compensation, and that their additional generosity was unnecessary, but that their appreciation of the honor was none the less sincere.

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Convention Notes.

Mr. Frank G. Cook, representing H. S. Peters, of Dover, N. J., is an energetic salesman. He tried to sell the mayor of Reading a suit of overalls, and then held up a clergyman to tell him the advantages of union-made goods. He took orders from everybody who stood still long enough to be measured, including Grand Chief Trout, on which, judging from the size, he must have lost money.

Charlie Curran, of the firm of O. F. Zurn & Co., was there from start to finish, and, as usual, was generally surrounded by a crowd of admiring friends. Charlie is an old convention favorite, and Reading was no exception.

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Delegate Peterson, of Atlantic City, said, "Yes, I've had a good time;" and we guess he did, for he knows what a good time is and can't be fooled with a counterfeit article.

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Where is Smith? Did any one see him?

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"Tom" Keogh left his wine for the waiters, but a gentleman seated near him at the banquet says he has an enormous appetite for spring chicken and ice-cream.

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Frank Duember had two White Star oil filters filled with Pittsburg stogies, which he distributed lavishly and with fiendish delight.

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The "State of Manayunk" was there "early and often," and his principal delight seemed to be derived from heaping abuse upon the editor of this journal. We were informed, however, that the "State" would not have risked going to Reading but for the fact that one of the city officials was a relative and had assured him that he would be safe.

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John Cook, of Jenkins' Bros., was on hand with his perpetual smile and an inexhaustible supply of good stories, but between times he was kept busy making explanations for Le Compte, whose pastorial garb and general air of apparent modesty caused him to be frequently mistaken for a clergyman, even by the ladies. Holy smoke!

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Mr. Bashlin said, "Good-by, boys; but before parting permit me to say that you are genuine and unadulterated bricks of the first water, and I shall be with you next year without fail. Rest assured that my regret at parting is only equalled by my duty to my family and my business."

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The latest reports from Smith indicate improvement.

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Mr. Weinland, inventor of the Weinland tube cleaner, manufactured by the Lagonda Manufacturing Company, Springfield, Ohio, visited the convention for a few hours, during which time he was kept busy by the exhibitors.

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Mr. William Weaver, manager of the supply department of the James Smith Machinery Company, Philadelphia, saw to it that not only the delegates but every man, woman and child in Reading received a sample of Smith's expansion packing.

Selection of an Air Compressor.

The recent use of Compressed Air has brought the air compressor to the attention of the Engineer in a very forcible manner during the past few years. It is not so long ago that it was very uncommon to find an air compressor anywhere, except in a mine or quarry. To-day it is very uncommon to find an Engineering works of any prominence which does not use compressed air. Yet a majority of these users do not give the thought or attention to the selection of an air compressor which they would give in the purchase of an engine or boiler. There is but little familiarity with compressors or compressed air machinery. For this reason we are at a loss to know how to draw up specifications for a compressor. And I must say right here that the manufacturers of compressed air tools have been much to blame for this condition. They have often been so eager to make sales that they have made statements that their tools use a certain amount of air per minute. While in reality they consume from 15 to 50 per cent. more air than they are guaranteed to use.

In the purchase of an Air Compressor one of the first essentials is to examine into the reputation and experience of the builder. We must learn if the builder has been successful in building compressors of the pressure requirements which we are in need of.

First, we must determine upon the steam pressure available, if our compressor is to be steam driven. Second, we must determine the amount of free air which we are to compress per minute and the terminal pressure which we are to reach.

We must now determine whether we are to use compounded or simple steam cylinders, and if we are to run condensing.

We now come to the most important point and yet the point most often overlooked, which is, will we purchase a machine with two-stage or compound air cylinders. If we are to use a machine of more than 100 or 125 cu. ft. of free air capacity per minute, we should certainly select one with compound air cylinders. The cost of these will be somewhat in excess of the cost of a simple machine. Yet the saving and economy will more than pay for the extra cost. We should also see to it that our compound compressors are provided with an intercooler of liberal capacity, between the low and high pressure cylinders.

Ascertain from the makers if the compressor, which he is recommending, is of theoretical or actual capacity. Make the builders guarantee actual deliver or capacity at a given piston speed. The figures of capacities usually given in catalogues are for theoretical capacity figured upon piston displacement and are from 1 to 3 per cent. too high, depending upon the amount of clearance space in the valve passages and cylinders.

Other questions being equal, we should select the compressor with the least amount of clearance space. Be careful and get a compressor which is so arranged that it will not be necessary to draw the intake air through heated cylinder heads and pistons. Doing this rarefies the air and we are not getting as much air into our cylinder as we expect to.

We should look as carefully into mechanical details and liberal bearing surfaces as in the purchase of a steam engine. I have seen many air compressors which have given great trouble by running hot.

The air valves should be so arranged as to be easily removed for repairs and inspection. There are many governing and unloading devices, some of them excellent and some of them

bad. These should be examined very closely. We should get a compressor which is well jacketed, especially upon the cylinder heads, which are at the points of greatest temperature.

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The Indicator and Its Value.

The indicator for determining the inner workings of the steam engine was first originated over one hundred years ago by that celebrated engineer, James Watts. It has since then, in its different improved forms, aided materially in the perfection of our present steam engines, not only by enabling the engineer to ascertain the exact values of the forces from which power is derived, but also by pointing the precise periods in relation to the different parts of the stroke at which these elements of power come into action.

The original machine of Watts consisted simply of a cylinder about six inches long and one inch in diameter, into which there was fitted a piston and was attached to the engine cylinder by means of a suitable pipe fitted with a valve to open or close communication between them. A long open coil spring was used, of which one end was fastened to the piston and the other to the cover of the indicator cylinder; this spring resisted the pressure of the steam in one direction and also the pressure of the atmosphere in the other.

A pointer was connected to the piston and moved directly with it and served to locate the atmospheric line or zero; and all motion of the pointer was above or below that point. There was no paper drum; the pointer merely indicating on a scale the highest and lowest pressure in the engine cylinder measured from the atmospheric line. Later the originator made an improvement on this instrument by adding a flat slide to which a sheet of paper was secured and giving it a coincident movement, on a reduced scale with the engine piston, by attaching a cord from it to the crosshead or some other moving part of the engine and returning the same by means of a counterweight. This machine in its improved form, though crude and less compact in construction, was to all purposes identical in its workings and the results obtained to the many different instruments now manufactured for this purpose, as it enabled the inventor to ascertain the exact mean effective steam pressure throughout the entire stroke, and also the proportion which the vacum in the cylinder at different parts of the stroke bore to that in the condenser, in order to determine the dimensions of cylinder required for any given power, as also the relative proportion proper to be given to the steam and exhaust ports of the slow speed engines of his experiments.

It was about fifty years later before anyone succeeded in making an improvement upon the design and construction of the original; this was finally eflected by William MacNaught, of Glasgow, Scotland.

This instrument was unlike those of to-day that have a parallel and multiplied movement of the pencil as compared with the piston. In his machine, MacNaught arranged the movement of both coincident, that is, whatever motion is imparted to the piston by the steam, the piston moved precisely the same distance either way. As constructed in this way, the spiral spring opposing the force of the steam against the piston was liable to disarrangement and a certain unevenness on account of the greater length of spring necessary to obtain cards of a sufficient height for computation.

The general adoption of the latter form of machine has led to many important improvements in the construction of the indicator, and undoubtedly aided in a large degree in the elevating of the standard of duty of steam engines, and also demonstrated conclusively the benefits accruing from the utilization of the expansive power of steam. While the indicator has long been considered an absolute necessity to those in the higher ranks of the engineering profession, it is regretted that some engineers still look upon the indicator with apathy and indifference, but therein they make a great mistake, not only in the interests of their employers but in their own personal interest, for it is only by the use and knowledge of the indicator and its purpose that they can become acquainted with the inner intricate workings of steam and the steam engine in its various details, which is certainly a requisite to the advancement and success of those who choose steam engineering as a profession.

While being the same in principle of construction as the indicators of to-day, the earlier types of the instruments were so crudely constructed, the parts so cumbersome and heavy, inducing vibrations and tardiness at the different events of the stroke, such as admission of steam, point of cut off, and also compression, that they were practically useless for any other than engines of very low rotative speeds.

The present improved construction of some of the modern indicators, in which as near as can be expected perfection has been attained, consisting in superior designs, simplified construction, a better adaption of the pencil mechanism, also finer adjustment of the moving parts, practically eliminate the effects of inertia and momentum of these parts.

These are qualities, which in order to be sure of reliable results in making tests of high speed engines, are absolutely indispensable.

The information which may be derived from a careful study and attentive application of the indicator to engines of any description is almost incalcuable to the engineer, because many facts are accurately determined by its use that cannot otherwise be obtained with any degree of correctness, consequently its use enables the engineer to discover many unforseen and unknown defects in the engine, which might by lack of knowledge be veiled in mystery.

At the present time the value of the indicator has become so universally recognized that manufacturers of high grade engines, as a rule, make provision for its application, and do not consider their engines complete until the valves have been correctly adjusted by the use and assistance of it, and set in such manner as that the maximum efficiency of the engine shall have been attained.

As the physician is to the human body, so is the engineer expert in the use of the indicator to the steam engine; by its use he can determine the ills of the engine as readily as the able doctor can detect those of his patient, despite the fact that the patient has the power of speech and thought. Thus it can readily be seen that an engineer without a knowledge of (and if possible the possession of) the indicator is like the practising physician without a diploma, very liable to the imputation of the name "quack."

The Practical Engineer.

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By L. L. RICE, 1213-15 Filbert Street, Philadelphia, Pa.

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Brother Walter Randall, of Old Colony Council at Rockland, Mass., was visited at his home on Saturday evening, May 3d, by the members of Old Colony, who presented him with a handsome arm-chair, and also presented Mrs. Randall with a beautiful Turkish rug. Refreshments were served by Mrs. Randall and the party enjoyed themselves until a late hour.

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Iron City Council No. 21, of Pittsburg, Pa., has enrolled over fifty additional members since it was instituted on April 19th.

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Grand Chief Trout, of Pennsylvania, has deputized First Assistant Grand Chief John Kelly to look after the Philadelphia district. Brother A. D. Hamilton, of Iron City Council No. 21, has been appointed deputy Grand Chief for Western Pennsylvania.

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Kensington Council Will Hold Open House.

Kensington Council No. 3 of Philadelphia, which meets at Frankford Avenue and Master Street, will hold an open meeting on Thursday evening, June 12th, to which all engineers are hereby invited. The entertainment will include an exhibition of stereoptican views, several short lectures on mechanical subjects, and last, but not least, one of the delicious luncheons for which Kensington is famous.

A New Council in Philadelphia.

Germantown Council No. 22, American Order of Steam Engineers, was formally instituted at Baettie's hall, Wayne Junction, Philadelphia, by Supreme Chief Engineer Clifford P. Williams, on Wednesday evening, April 30th. Mr. Williams was assisted by Grand Junior Master Mechanic Thomas Marshall, Jr.

JOHN P. RICKARDS,
CHIEF ENGINEER, GERMANTOWN COUNCIL.

The new Council is composed of a most excellent lot of fellows, and starts off under the most favorable conditions with sixty-two charter members. The officers are as follows: Chief engineer, John P. Rickards; first assistant, John Newhall; recording engineer, I. J. Rosboshil; treasurer, John Albus; senior M. M., Charles H. Dettrey; junior M. M., Leidy P. Souders; inside sentinel, George Akroyd; outside sentinel, John Brayman; trustees, J. L. Jamison, John Newhall, Wm. M. Doyle; past chiefs, John Newhall and John Albus.

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Delaware Council.

Editor PRACTICAL ENGINEER:—

Delaware Council No. 1 begs leave to report "sumpin is duin' down here." Old members are paying up their back dues, and we are initiating new members. For a while things seemed to be standing still, but there now is a new and active spirit being manifested by the membership, no doubt due to a few of the old reliables getting their heads together and planning for increased interest. Efforts are being made more especially along these lines, viz: collection of dues, interest in meetings by having a committee to secure each week a speaker for, or a discussion on, some educational work relating more particularly to our profession. In this connection the PRACTICAL ENGINEER is our text-book, and the articles in it furnish topics of interest to all, and lastly, assisting our members in securing positions. How we do this is best explained by the enclosed card. Efforts are being made to send one like it to every employer and steam engineer in our city.

With best wishes,

A. EDWARD RHODES.

A New Council in Texas.

Galveston Council No. 1, American Order of Steam Engineers, which was recently organized, has elected the following officers:

S. A. BISBEY.

Chief Engineer, Max Levy; first assistant, J. B. Bisbey; recording engineer, J. Lamah; corresponding engineer, A. L. Bradford, Engineer, Union Depot; treasurer, S. A. Bisbey; chaplain, C. R. Hawkins; senior M. M., J. A. Beanlieu; junior M. M., T. J. Wilson; inside sentinel, L. M. Byerly; outside sentinel, J. S. Ames; trustees, Robert Hayes, George H. Wright, and J. A. Beanlieu.

The Council already has twenty-five members and excellent prospects for future development. Mr. S. A. Bisbey, whose portrait we reproduce herewith, was largely instrumental in organizing this Council, and is extremely popular with the engineers of Galveston He is chief engineer for the Galveston Cotton Compress and Warehouse Company.

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The Superiority of Cork as a Non-conductor.

Mr. Geo. H. Barrus recently conducted rather exhaustive tests of several of the leading brands of steam pipe coverings at the new power plant of the Manhattan Elevated Railway, New York City.

These tests were made with the idea of testing the efficiency both comparatively and absolutely, of the coverings as ordinarily manufactured and sold. In order to best understand the whole matter, a few statements may be made regarding the general scheme of installation, the method of tests and the results obtained.

First, as to the arrangement of the testing plant.

The plant is divided into two sections, one for coverings designed to stand the highest pressures which are now regularly carried by the modern power plants, say 150 pounds per square inch, and the other for lower pressures such as have been in vogue for many years past, say 80 pounds per square inch.

It was sought to install a testing plant for the purpose in view that should be on a sufficiently large scale to approximate to practical conditions of service, rather than make it a labratory apparatus and a labratory test which characterizes much of the work heretofore done in this field of testing.

That the work might also be carried out on a commercial scale it was sought to make and continue the tests a sufficient number of hours continuously in a day, and a sufficient number of days in succession, that no question could be raised as to the reliability of data from too short duration, or from want of continuous repetition. Many of the coverings have, therefore, been tested day after day for a period of a month, and every one has been subjected to at least three days' run from 8 to 9 hours continuous test each day.

The size of the pipe selected for the leading tests was the ordinary standard two-inch steam pipe, and the length selected, 100 feet for each pipe. That the effect of size of pipe on the results might be studied and exhibited, and at the same time the work brought into line with the practice of high pressure power plants, especially as regards much of the engine and boiler room piping, two 10-inch pipes, each 35 feet in length, form a part of the 150 pound section of the apparatus.

The 2-inch pipes in the 80-pound section of the plant are numbered for reference 1, 2, 3, 4 and 5. The 2-inch pipes in the 150 pound section are designated 6, 7, 8, 9, and the 10-inch pipes are numbered 11 and 12.

So much for the leading features of the plant. Taking up next the coverings themselves; these were bought in open market, they were samples of the coverings which are supplied by the various manufacturers in the ordinary course of business.

They were applied by workmen familiar with the application of pipe coverings, under intelligent supervision, well butted, jointed and secured. During the progress of the tests they were frequently pointed up with cement where the joints through continued service had become defective, the same as would be done by the repair force having the care of a steam plant in commercial service which is well kept up. Before the conclusion of the tests opportunity was given the representatives of each covering to visit the plant, examine his goods, criticise their application and where defective, correct the defects.

Pipes No. 6 and 12 were covered with "Asbesto-Sponge Felted" covering made by the H. W. Johns Mfg. Co. The thickness of the two-inch covering was 1⅛ inch before application and that of the ten-inch 1$\frac{3}{16}$ inch. After application, the circumference of the outside of the covering on No. 6 pipe measured 15.18 inches, and that on the No. 12 pipe 42.75 inches. The circumference of the outside of the bare pipe in the case of No. 6 was 7.54 inches, and that of No. 12, 33.85 inches. The distance from the outside of the covering to the outside of the pipe in the case of No. 6 averaged 1.21 inches, and in No. 12, 1.41 inches. The number of laminations of Asbesto-Sponge, of which these coverings were composed, was an average of 59 for the 2-inch pipe, and 66 for the 10-inch pipe. The coverings on the two pipes No. 6 and No. 12 were the same as those used during the closing days of the previous Comparative tests, and they had not been removed from their positions or in any way changed. The covering on the 10-inch pipe was 3-16 inch thinner than that originally furnished, and the full thickness of 1 3-8 inches was used during all but one

day's run of the Comparative tests. The reduced thickness was obtained by removing 10 layers from the outside of the original covering, the original number being 76.

Pipes Nos. 7 and 11 were covered with Nonpareil cork applied by their men. These coverings consisted of two layers of asbestos paper, each about 1-16 of an inch thick, and a layer of Nonpareil cork, which in the case of the 2-inch pipe was 15-16 of an inch thick, and on the 10-inch pipe 1 inch thick, surrounded by a covering of heavy canvas, which served as a finish. The total thicknesses before application were respectively 1 1-8 inches and 1 3-16 inches. The circumference of the covering on the 2-inch pipe after application averaged 14.75 inches, and the circumference of the bare pipe averaged 7.52 inches. The distance from the outside of the covering to the outside of the pipe averaged 1.15 inches. The circumference of the covering applied to the 10-inch pipe averaged 42.73 inches, and that of the bare pipe 33.85 inches. The distance from the outside of the covering to the outside of the pipe averaged 1.41 inches.

The data and results which are given in the appended tables show a decided superiority for the Nonpareil Cork Covering. The saving by cork is 90.9 per cent. and that of the Asbestos Sponge Felted, which was the next highest in the test, is but 90.5 per cent. It is well to note that in the matter of the two-inch coverings the Nonpareil coverings were but 15-16 inches thick. The tables show that despite this it averaged as well as that of the heavier covering—Asbestos Sponge Felted. From this it appears that the efficiency of the coverings tested, that is, the percentage of heat radiated from the bare pipes which is saved by the coverings, is as follows; the condensation in the bare pipes having been determined for the previous Comparative Tests.

Nonpareil cork on 2-inch pipe, 84.8 per cent.

Nonpareil cork on 10-inch pipe, 90.9 "

Asbesto-Sponge Felt, 59 Laminations on 2-inch pipe, - - - 85.3 "

Asbesto-Sponge Felt, 66 laminations on 10-inch pipe, - - - 90.5 "

The following is the report of Mr. Barrus upon the durability of Nonpareil Cork:

"I have carefully examined a section of the Nonpareil Cork covering taken from one of the 2-inch pipes of the Bullard Machine Tool Co., Bridgeport, Conn., which it is said has been in use since March, 1900, under a pressure of 130 lbs. per square inch; also a section taken from a 2-inch pipe at the works of the Bridgeport Brass Co., which it is said has been in use since November, 1900, at a pressure of 100 lbs. per square inch; also a section taken from a 2-inch pipe at the Morgan Envelope Co.'s works at Springfield, Mass., which is said to have been in service about one year at 85 lbs. pressure; all these coverings being similar to the 2-inch covering referred to in the above tests. In each of these samples, there is evidence of the effect of heat to which the covering has been subjected, the cork being discolored, especially in the region close to the asbestos and it is also somewhat brittle. There appears to be, however, no serious deterioration, as far as can be judged from an outside examination.

The Arrangement of Boiler Tubes.

By R. T. Strohm.

The greater part of the heat generated in the boiler furnace by combustion is conveyed to the water inside the shell by conduction, through the agency of the boiler plate itself. The greater the amount of heating surface exposed to the hot gases, the greater will be the amount of heat absorbed and transmitted to the water. However, it is even possible to have a superabundance of a desirable thing, and this can be very plainly and strikingly illustrated by certain arrangements of the heating surfaces of ordinary return tubular boilers.

The major portion of the heating surface of a boiler of the return tubular type is contained in the tubes themselves. And for that reason it is essential that these surfaces be arranged so as to take up the greatest amount of heat consistent with the best results. It will not do to crowd these tubes into every available space. For instance, if it were desirable to put a maximum number of three-inch tubes into a boiler, it could be done by staggering them, so that the distance from the centre of any tube to the centre of each of the six around it would be the same in every case. But at the same time the heating efficiency would be greatly reduced by such a method of procedure.

It is true that the greatest possible amount of heating surface would be obtained, and it would be natural therefore to suppose that the maximum amount of heat would be transmitted to the water since the amount of heat transmitted is directly proportional to the area of surface.

But we have another consideration also in this law governing heat transmission in the boiler. The amount of heat taken up by the water is dependent upon the rapidity of the water circulation. Therefore, to stagger the tubes so as to obtain a large heating surface is to directly hinder the free and easy circulation which should be found in every steam boiler. In other words, we have sacrificed one advantage almost entirely to partially further another.

The circulation in a steam boiler is a most important item, and cannot be disregarded, aside from the fact that it brings a greater number of water particles into contact with the hot plates in a given time. For in a measure it also aids in preventing deposits of sedimentary matter which would otherwise be free to settle and bake into a hard scale. By the continuous agitation of the water, due to a good circulation, this matter is kept in motion and is thus prevented from adhering to the plates or to the tubes to any great extent.

Further than this, if a boiler has a certain amount of scale upon its water surfaces, it is possible that at some point the plates may be overheated. A rapid and efficient circulation will act as a partial safeguard against this, in many instances, since it tends to mingle the water thoroughly and so to maintain all parts of the shell at about the same temperature.

If the benefit of a free and unbroken and at the same time rapid circulation was fully realized by boiler designers and builders, more attention would be paid to this point. The circulation should have a definite path or circuit and the placing of the tubes should be such as to further this passage of water from one part of the boiler to the other.

In the return tubular boiler, the hottest portion of the heating surface is that directly over the furnace, above the grates. For it is at this point that the gases of combustion first strike

the shell. Consequently we may rightly expect to see the water rise from this portion. This it does, in a vertical direction, and it is for this rising current that the placing of the tubes must be carefully considered.

It is but natural that the water should rise most rapidly from the plate that is hottest, since at this point it attains its least specific gravity. We expect then to find a strong current in an upward direction just above the furnace. And in this we are not disappointed. Experimental boilers have been built with a view to observing this and other actions within the boiler. They have a hole cut in the plate at the side of the boiler above the water line, over which opening is placed a double thickness of the best and strongest glass. Through this hole a ray of light is reflected so as to illumine the interior. When under ordinary firing these boilers showed that the water rose so fast from the hot furnace plates that it actually piled up above the surrounding level of the water in the remainder of the boiler.

Hence we have here a strong reason why the tubes should be placed in vertical rows and not staggered. Also, since the heat is greatest along the lower part of the shell it would be well to place the middle vertical row of tubes slightly further apart than the others, say double the distance. While at no part should the distance between rows be less than one and one-third times the diameter of tube, measuring from centre to centre of adjacent tubes.

The water that rises at the centre of the boiler divides near the surface and flows in horizontal currents toward the rear and the sides of the boiler, and then down again. Consequently the tubes must not be carried too near the shell at the

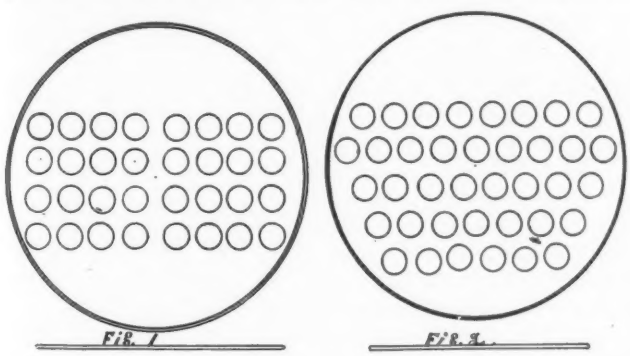

Fig. 1 Fig. 2.

sides. The flange of the head is sufficient to support the head for a distance of three inches and more from the shell, so that there is no necessity for carrying the tubes closer than this, on the ground that the head needs bracing or staying.

Again, it is not economical to have the tubes too near the bottom of the boiler. If a manhole is placed at the bottom of the front head as is done with many return tubular boilers there will be no tubes just above the lower plates, and there will be a considerable body of water immediately over the furnace.

This will give a better chance for the circulation to become well established before dividing among the tubes on the upward trend. And, moreover, tubes placed near the bottom of the boiler do not add appeciably to the efficiency of the heating surface or to the performance of the boiler. This has been proven by conducting tests upon boilers, first with the lower row or rows open, and then with them plugged up. The results in both instances were practically the same. This is due to the fact that these lowest tubes convey only the coolest of the gases, so that the gain is rapidity of circulation when they are left out is greater than the heating effect secured by leaving them in.

The distance between the top of the shell and the upper row of tubes is also a matter of some consequence. The water level must be carried at least four inches above the upper row of tubes and so if they are carried too high the steam space is correspondingly diminished. This is poor practice, and in case the boiler is forced slightly it is almost certain to prime.

It will depend largely upon the use to which the boiler is to be put as to the amount of steam space required. If it is used to supply an engine, it should have a steam space of at least one-third the entire cubic contents of the boiler. If used for steam heating, dry steam is not so important, and so the steam space may be smaller than when used as a supply for an engine.

The use of steam domes and drums allows a water level higher than would otherwise be allowable. In such cases about one-third the diameter of the boiler should be the distance between the top of the tubes and the top of the shell. Without a dome or drum this should be increased to two-fifths the diameter of the shell.

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Selecting An Engine.

By W. H. WAKEMAN.

The following suggestions are made concerning the best type of engine to select for operating an electric railway, or for any other place where the load varies from the power required to operate the machinery in the station, or engine room, with no load whatever, up to the full power of engine with cut off taking place beyond one half stroke. For such work the load varies from the lighter to the heavier in a few minutes, several times per day, with all kinds of combinations between these extremes.

This does not represent the worst conditions possible, for nothing can equal a cable road for extreme variation, as the engine has a full load at a certain time and a few minutes later the cars are coming down a hill, hence are running the engine by force of gravity, as no steam is entering the cylinders. As these cases are very scarce they will not be taken into consideration, but there are many places where the variation is very great every day, and to these we will give attention.

The compound noncondensing engine, cannot be considered because it is only adapted for a nearly uniform load. With a heavy load and late cut off it is not economical because the full benefit of expansion is not realized, for it is not proper to make the low pressure cylinder large enough to provide for such conditions. If it were so designed, it would not work well when the load is light, making the cut off short, for steam would be expanded below atmospheric pressure in the high pressure cylinder, thus making the low pressure piston a dead load, on account of the larger surface exposed to back pressure.

The compound condensing engine gives good results when the load is nearly uniform, and the engine and load are adapted to each other, but when there are great variations in the load it effects the economy quickly. As the air pump removes nearly all of the back pressure, the low pressure piston is not a load on the high pressure, for in nearly every case the mean effective pressure in the low pressure cylinder is more than enough to drive the piston, even when the load is light. This

makes the work of the air pump of no use except to prevent the low pressure piston from becoming a dead load, but it is the most economical way for removing the back pressure which is a large and important factor, when we consider the large area exposed to pressure.

This type of engine is costly to build and expensive to maintain, therefore it does not prove a paying investment unless its load is proportioned to give the best results for a greater portion of the time. When the triple and quadruple expansion engines are considered in the same light, we find that these objections apply with even greater force, for it is only when the load and the engine are adapted to each other all of the time, that the excellent results we read of can be secured.

This brings us to a consideration of the simple noncondensing engine, which is not costly to build, and inexpensive to maintain. When all of the knowledge we have is put into practice in designing and building this type, the results are fair, so that if it is possible to sell the exhaust steam, or use it to good advantage, it will compare favorably with any other type, when the load varies greatly.

The great objection to it is that its piston must constantly work against atmospheric pressure, thus putting a dead load on it every hour that the fly wheel revolves.

As this amounts to about 15 pounds per square inch at sea level, four-fifths of which may be dispensed with to good advantage, it points out the disadvantage of this kind and it is a serious one too.

It costs no more to build a simple condensing engine to run a given amount of machinery than if it were to be run noncondensing, when a first-class machine is required in both cases, but the air pump, etc., are an additional expense which the results fully warrant.

Where a simple condensing engine carries a light load with a high boiler pressure, the cut off is short and the terminal pressure so low that when the next charge of steam is admitted, the condensation is excessive, therefore, the results are not equal to those secured when the cut off is longer, with the same boiler pressure, but even with the lighter load it is more economical to run condensing, therefore, the simple condensing engine is the most economical type to adopt, for a place where the load varies greatly at short intervals.

When considering these types we assume that water for condensing purposes does not cost anything except the expense of running a pump to raise it to the required height. In localities where water must be purchased, a cooling tower can be used, when the cost of water to run condensing will be no more than for a noncondensing plant.

The cost of pumping water for such an engine is more than it would be under other conditions, for the load changes without notice, therefore the air pump must be set so as to raise water enough for the greatest load that will be put on. When some of the load is thrown off more water is pumped than is actually required, but there appears to be no practical way of regulating the supply automatically.

Even with these unfavorable conditions the simple condensing engine will show results that compare favorably with any that have been secured from simple noncondensing engines, and during the time that the engine is better adapted to the load put upon it, the coal required per horse-power will be much less, because the total load is less.

If the cylinder of such an engine is so large that when the full load is on, the cut off takes place at about three-eighths stroke, it will be very short for the lightest load, therefore the best results possible cannot be expected.

In order to be fitted for such extreme variations, its steam valves should be operated by one eccentric, and its exhaust valves by another, then it will be possible to get a cut off at 5/8 or 3/4 stroke if the maxium load calls for it, and with the lightest load it will give fair results.

When the boiler pressure to be carried is known, also the speed required, a cylinder can be designed that will meet these requirements, provided the exact maximum and minimum loads are known in advance.

On account of the difficulty experienced in determining these points, many engines fail to give the results expected of them, and are condemned accordingly.

Sometimes an engine that belongs to a type which is not noted for economy, runs quietly, repair bills are small and seldom appear, and the cost of fuel is reasonable. In the same vicinity there is an engine that belongs to a type celebrated for its economy, yet it is noisy, repair bills are large and the cost of fuel is excessive.

What causes satisfaction in one case and dissatisfaction in the other? The former engine is in charge of an engineer that understands his business, and constantly works for the interests of his employer, who appreciates his services and pays him a good salary. The latter engine is in charge of a man who prefers this business to any other because he considers it easier. He is convinced of this because he does not perform all of the duties that a thorough and conscientious engineer would consider a part of the program, hence he has much leisure time on hand. His employer believes that an engineer is a necessary evil, is sure that one man is as good as another, pays the lowest rate of wages that he can secure a man for, and is constantly dissatisfied with the result.

This human element is not always taken into consideration when an engine is to be selected, yet it is an important point that should not be overlooked.

When the manager of a certain firm found it necessary to buy a new and larger engine, he asked a competent engineer what kind of an engine he should purchase. He was informed that if he intended to continue his present policy (which resembled the latter case above described) he had better buy the cheapest thing that he could find, but if he intended to have the engine and boiler room run on scientific principles it would pay to install a good Corliss engine.

It was decided to buy up-to-date machinery and have it given the best of intelligent care, paying a good salary to the engineer in charge. Although this plan was adopted more than ten years ago, it has not been abandoned as unsatisfactory.

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A mixture of ten parts of black oxide of manganese and one part litharge will stop a small leak in a steam boiler in an emergency for a little while, but the leak itself is evidence of structural defects that needs radical treatment.

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Pumps now raise, convey and deliver water, beer, molasses, acids, oils, and melted lead. They also handle such gases as air, ammonia, lighting gases and even oxygen.

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A pump will not raise hot water because the vapor from the water fills the vacuum as fast as it is created and this destroys its force, hence, no pump however good, will lift hot water.

LETTERS FROM ENGINEERS

In order to make this department of THE PRACTICAL ENGINEER as interesting as possible, a moderate rate will be paid by us for all contributions published under this heading. However, we do not assume responsibility for the ideas or opinions expressed. None need hesitate to contribute because of inability to draw or write well. We will redraw or revise whenever necessary—it is the idea we want. New ways of doing old things, criticisms of accepted theories and general engine room experiences are especially solicited.

Ammonia Effect on Copper or Brass.

Editor PRACTICAL ENGINEER:

P. T. L., Philadelphia, Pa., asked me in the last issue of THE PRACTICAL ENGINEER if I ever run a refrigerating plant or cold storage system where brass or copper came in direct contact with ammonia. I would say that I had charge of such a system on board a steamboat, and I did not find any corrosive effect whatever occuring through the contact of the ammonia upon either the copper or brass. So it is evident that the corrosion of P. T. L.'s brass or copper fittings occurs through some other agency than ammonia.

Ammonia contains no acid whatever, while the caustic properties existing in ammonia will destroy anything of the animal kind, it cannot effect either copper or brass.

The basic principle of ammonia (ammonia chloride) is used largely in dyeing and in certain processes with metals, such as tinning, soldering, silvering, copper, brass and galvanizing iron. It is used to cleanse the metal, not to effect it otherwise. Some of the strongest acids known, such as hydrocloric acid and sulphuric acid, either of which is very corrosive, will not very readily effect either brass or copper and I might add that only those acids very rich in oxygen are in any way serious in their action upon these metals; hence why should ammonia when containing none of this acid condition be productive of a disintegrating effect.

HARRY W. SHERMAN, Wilmington, Del.

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Booster Losses.

In answer to query of Educational Committee A. O. S. E. in February issue of PRACTICAL ENGINEER, in regard to number of losses by using a booster in the power house to boost the current up to 50 volts higher than the generator voltage, I beg to submit the following:

A booster consists of an armature driven in a magnetic field and through whose windings passes the entire current of the circuit in which it is placed, its object being to increase the voltage of the circuit. Usually there is a combination of two direct connected machines, one of which acts as a motor and drives as a dynamo the other machine or booster. Sometimes there is a single field with the motor and booster windings on the same armature.

A booster may be used on an incandescent lighting or railway feeder leading to a distant point, in order to raise the E. M. F. to compensate for its abnormal drop; or in an auxiliary storage battery installation to add sufficient E. M. F. to the dynamo voltage to charge the cells. But, in this case, the booster is used in a power house and the supposition is, that it is two direct connected machines, one of which acts as a motor and drives as a dynamo the other machine or booster. This method is used in almost all power houses and central stations at the present time where the service of boosters is required.

The total loss of power in a dynamo or motor can be separated into smaller losses, depending upon the manner in which the loss is produced and the part of the dynamo in which it occurs. In ordinary cases, all the losses will come under one of the following heads:

1. Mechanical friction loss.
2. Core loss.
3. Field loss.
4. Armature loss.

The larger part of the loss due to "mechanical friction" takes place between the bearings and journals. The friction of brushes on the commutator and windage produces consequent loss. The friction of the brushes and the loss in the contact resistance of the brushes, are frequently quite considerable, especially with low voltage machines.

Core loss is the energy converted into heat in the iron disks of the armature core when they are rotated in the magnetic field. A small portion of this loss is due to Foucault or eddy-currents generated in the revolving core disks. The larger portion of the loss is due to a magnetic friction which occurs whenever the direction of the lines of force is rapidly changed in a magnetic substance. When the magnetism of an electric magnet is rapidly reversed that is when the direction of the lines of force is suddenly changed several times in rapid succession by reversing the direction of the magnetizing current the iron or steel in the core becomes heated, which necessitates a certain amount of energy being expended. This effect is due to a kind of internal magnetic friction by reason of which the rapid change of magnetism causes the iron to get hot. This is called hysteresis. The production of eddy or Foucault currents in different parts of the machine in another very important action which occurs when the machine is working. This term is applied to the currents which are always produced when a solid metallic mass is rotated in a magnetic field, or is subjected to the action of a magnetic field which is undergoing change in its intensity or strength, for the reason that the currents generated always tend to flow in more or less circular paths. When produced in large solid metallic masses, the strength to which these eddy or Foucault currents attain is frequently very considerable, owing to the low electrical resistance of the masses in which they flow; and in addition to consuming a large amount of energy, they frequently occasion a large and dangerous rise in the temperature.

The cores of armature, which always are made of iron, are subject to the detrimental influence of these eddy or Foucault currents unless they are suitably constructed; as is also the case with the conductors wound upon the core if these are of large cross-sectional area. It is impossible to entirely prevent the generation of these eddy or Foucault currents. They can, however, be prevented attaining any considerable strength, by suitably interposing resistance in their path. With this object, the cores and conductors of armatures are laminated or subdivided into a number of small parts, each of which is electrically

insulated from the other by some insulating material. This suggestion was first made by a Frenchman by the name of Foucault who first explained the cause of heating of armatures and magnets, by showing that currents of electricity were produced within the mass of the metal when it was rapidly magnetized and demagnetized or when it is subject to sudden and continuous changes of polarity, and these being short circuited within the metal, produced the heat. This is why these currents are called Foucault currents.

This booster and motor previously described to boost current up to 50 volts, we will say have separately excited fields from the fact that its field magnets are excited or magnetized by a current from some external source, as for instance another continuous current dynamo or station bus-bar. This energy is considered as one of the losses. The field rheostat of the dynamo or booster is also taken in as one of the losses.

The principal armature loss is that produced by the current in flowing against the internal resistance of the armature; that is, the resistance of the armature conductors. The core losses previously described could also be classed as part of the armature losses, but it is usual to consider them apart. The armature loss when properly expressed is usually termed the copper or wire loss since it is due to the resistance of the armature conductors which are composed of copper wire or bars. The armature loss depends upon the amount of internal resistance and upon the strength of current flowing through the armature conductors. In a given armature the internal resistance remains constant at equal temperature, while the strength of current varies with the load upon the dynamo at that particular moment; in other words, this loss only occurs when there is a current flowing through the armature—the stronger the current the greater is the loss. Aside from the losses mentioned, other small losses occur such as the resistance of brushes which would be greater in carbon than copper brushes, resistance of commutator leads, resistance of cables running to armature leads of motor, resistance of feeder running from booster to the distant point, and resistance of cable running from station bus-bar to booster. These, however, are usually small in commutating machines.

Respectfully yours,

Wilmington, Del. WILBERT D. WYATT.

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The Compression System of Refrigeration Answer to Questions in the March Number of "The Practical Engineer."

Question 1. Explain the compression system?

The medium used is anhydrous ammonia. The press consists of a complete cycle involving three successive steps. They are called respectively, *Compression, Condensation*, and *Expansion*. These three steps are made continuous and are constantly repeated. The ammonia is kept confined, thus the same ammonia is used repeatedly, the supply being replenished from time to time as losses unavoidably occur. At the beginning the ammonia is in the gaseous state, and is not far from the atmospheric pressure and temperature.

For the compression a compressor is used, which is a specially designed pump. The compressor is used to compress the ammonia to a pressure of from 125 to 175 pounds per square inch. The gas in the beginning, as in the case with bodies in general, contained a certain amount of heat. After compression it practically contains the same amount of heat as before compression. This heat is sufficient, even at the increased pressure, to maintain the ammonia in a gaseous state.

The next, or condensation process consists in removing this excess of heat. For this process a condenser is used. This consists of an arrangement of pipes for the ammonia, the pipes are either submerged in cold water, or have a continuous stream of water running down over them. The ammonia gives up the excess of heat to the cold water, and is in consequence reduced to a liquid.

It is in the expansion process that the refrigeration is produced. What might here be called the refrigerator consists of a net work of pipes arranged according to results desired. The compressor draws its supply of ammonia gas from these pipes. This net-work of pipes is called the expansion coils, in which a pressure of from 25 to 50 pounds per sq. inch is maintained. The liquid ammonia at the high pressure given is allowed to enter the pipes with the low pressure. The result is that the ammonia being relieved of the high pressure changes from a liquid to a gas by the heat it absorbs from the pipes in which it is inclosed. As the pipes are arranged in the spaces to be cooled, these supply the heat which the ammonia absorbs, thus reducing the temperature and accomplishing the results desired.

Why is it called a compression system?

From the use of the compressor which compresses the ammonia, the different parts of the system are, the compressor pump, condenser and the ammonia expansion coil, with other fixtures owing to the system used.

Ques. 2. What is the difference between the atmospheric and submerged condenser?

In the atmospheric condenser the coils of pipes are exposed to the air, and the water is allowed to run over the coil of pipe to effect the cooling. In the submerged type the coils are entirely covered with water contained in a narrow tank, the cool water being constantly fed in at the bottom and flowing out at the top. The atmospheric condenser is the most efficient in regard to the amount of water used, but requires a greater length of pipe in the condenser.

Ques. 3. Explain the difference between the direct expansion and brine system?

In the direct expansion system the expansion or evaporating coils are placed directly in the rooms to be refrigerated, and the ammonia is evaporated in the coils by coming in direct contact with the air in the room to be refrigerated, no brine tank being used. In the brine system the expansion or evaporating coils are placed in a tank which is filled with strong brine made of common salt, which is well known not to freeze at a temperature as low as zero. The expansion of the ammonia in these coils robs the brine of heat, the process of storing cold in the brine going on continuously and being regulated as required by the expansion valve. The chilled brine is circulated by means of a pump through coils of pipe, placed on the ceiling or sides of the rooms to be refrigerated.

The cold brine in its circuit along the pipes becomes warmer by reason of taking the heat of the rooms, and is finally returned to the brine tank where it is cooled as before, the operation being a continuous one.

Ques. 4. How is the brine circulated in the brine system?

By a pump. Is the brine circulation independent of the ammonia? Yes. When and where do they come in contact? In

the brine tank, the brine and its return from the room where it has absorbed heat enters the brine tank and is cooled again by coming in contact with the expansion coil which contains the ammonia which is going through the process of evaporation.

In ice making how is the brine tank arranged?

The freezing or brine tank is made of steel and well coated with water proof paint. The grating or framework to hold the cans in the tank are made of oak, and the covers are made of two thicknesses of 2 inch dressed oak. The frame work is well jointed and screwed together. The expansion or evaporating coils are arranged in parallel rows with space between each set to admit of a row of moulds or freezing cans which are submerged in the brine, with which the tank is filled. The water in the cans in being frozen gives up its heat to the brine, which in turn gives up this heat to the expanding ammonia in the expansion or evaporating coils.

J. W. E.

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QUESTIONS AND ANSWERS.

THE editor will be glad to receive from the readers of THE PRACTICAL ENGINEER, such questions relating to engineering subjects, as may, from time to time, occur to them. All questions and answers should be addressed to the editor and accompanied by the name and address of the writer, which will not be published, however, unless especially desired. It is the intention that questions shall be answered by the readers, and even though the editor may, from time to time, publish answers with questions, he especially desires the readers in such cases to contribute any further information in connection with the points raised, that they may consider of interest. All questions and answers received by the editor will be published, as far as practicable, but he reserves the right of editing or rejecting any communications.

Editor PRACTICAL ENGINEER:—

As I have been a reader of your journal for some time, I take the liberty to ask you if you can assist me in preparing a dry battery for a small lamp. The kind of material and the mode of construction, and what part of the work each kind performs. I find in taking one apart that it is constructed by five different kinds of material. The outside being zinc, then something that looked like cotton, then dry black powder, then with a center of hard substance looking like carbon, the top sealer with something looking like melted rubber. If you can give me the required information you will oblige,

WM. M. WATSON, Albany, N. Y.

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MR. WILLIAM ROCHE, of 42 Vesey Street, New York, a well known manufacturer of dry batteries, gave the following method in the Telegraph Age for making a dry battery at home.

"First make a zinc cup, then roll a cup or tube of blotting-paper about three or four turns, to fit tight inside of the zinc cup, and pour in the bottom of the cup about two tablespoonfuls of hot melted pitch or rosin, to insulate the bottom of the cup. Next make your solution. This is done by dissolving 5 ozs. of sal ammoniac in one pint of clear water. When so dissolved, add 7 ozs. of granulated chloride of zinc. Stir thoroughly till dissolved, and continue stirring every few minutes for one hour or more. The solution is then ready for use.

"The manner of making a negative or carbon element is to mix 8 ozs. of powdered black oxide of manganese and 16 ozs. of powdered carbon thoroughly together, and dampen or moisten with 5 fluid ozs. of the solution. If the carbon and manganese are very dry you may need a little more solution. All that remains now to complete the cell is to soak the blotting-paper inside of the zinc can thoroughly with the solution; fill the can about three-quarters full and let it stand a couple of minutes, then pour out the solution, place your carbon plate in the centre of the zinc can and pack in your carbon element good and hard. The packing will probably force a little of the solution up the paper by compression, but that will not injure the cell any. When the powdered elements are wet enough, clean away all particles of the carbon element from the top of the paper and zinc can, so that there will be no internal short circuit; seal your cell, and when you have your connectors on, the cell is ready for use. This formula will produce a cell from twenty per cent. to fifty per cent. better than most of the dry cells of the present day."

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Editor PRACTICAL ENGINEER:—

I have a problem which has bothered me for some time. I have been running at times a Corliss engine connected to an ice machine and I cannot convince myself as to what kind of pressure the head pressure gauge shows. The size of the engine is 18 by 42, running at 60 R. P. M. Boiler pressure is 90 pounds, and the engine cuts off at ¼ stroke. The compressors are two in number, single-acting, each 16 inches in diameter. The head pressure is 175 pounds and the back pressure 5 pounds.

Now, as I figured it, the mean effective pressure on the steam piston is 60 pounds, which would give a total pressure on the piston during one stroke as 15,267 pounds. For one stroke of the compressor there would be a total pressure of 35,185 pounds on the plunger. Now, if the head gauge, showing 172 pounds, registers the pressure per square inch, how can the 15,267 pounds overcome 35,185 pounds?

J. B. HUGHES.

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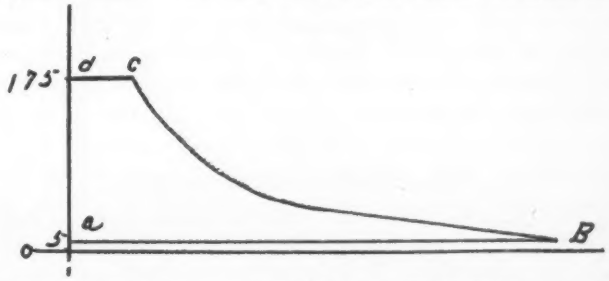
The head gauge does register pounds pressure per square inch, although your figures would seem to prove otherwise. The explanation lies in the fact that you have made a mistake in calculating the total pressure upon the face of the compressor piston. The area of a 16-inch circle you found to be



201.06 square inches, and this you multiplied by 175 pounds as shown by gauge, getting 35,185 pounds as the total pressure. Now, this is not the total pressure on the piston of the compressor. If you were to take an indicator card from your compressor, it would look somewhat like that shown in the illustration. You will notice that this is formed in a reverse manner from the engine diagram. From a to b the piston of the compressor is moving downward, taking in a charge of ammonia gas at five pounds pressure. At b the cylinder is

full of low pressure gas. Then the compression stroke begins, and from b the gas is compressed, as indicated by the curved line of the diagram. This records an increase in pressure and a decrease in volume. When finally the pressure has reached 175 pounds per square inch, the discharge valve opens at c and from c to d the gas is discharged into the condensing coils. Thus you will see, from the diagram, that during only that part of the stroke from c to d is the pressure on the piston equal to 175 pounds, and that during the remainder it is much less. By averaging this diagram as we would an engine diagram, we find that the mean effective pressure would probably not be higher than 50 pounds.

Then, we would have 60 pounds per square inch steam pressure acting on a piston 18 inches in diameter, to overcome an ammonia pressure of 50 per square inch acting on a piston 16 inches in diameter, which it could readily do. The total pressure, under these conditions, would be 15,267 pounds upon the steam piston per stroke, and 10,053 pounds upon the compressor piston per stroke. The difference is necessary because the engine must not only overcome the ammonia pressure, but also the friction and wind resistance of all of its parts. Your head gauge then registers pounds per square inch, as it was intended it should.

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Alcohol as a Fuel.

Discussing the fuels of the future, the New York *World* makes some curious statements concerning alcohol. It can be made anywhere, burns without smoke, is cheap to transport because it is highly concentrated. The Emperor of Germany is encouraging the growing of potatoes as raw material for the manufacture of fuel alcohol. "An exhibition in Paris of appliances for burning it industrially attracted visitors from all Europe, and practicable alcohol engines up to twenty-five horse power were shown. In our own country the Cornell University School of Forestry is making cheap alcohol from the hard timber left uncut by Adirondack lumbermen because it would not float down to their saw-mills.

"Alcohol can be made from fruits, grains, vegetables, from straw. M. Sartiaux gives its lowest cost of production at fifteen cents per gallon, equivalent to seven and one-half cents a gallon for petroleum, which has but one-half its fuel value. At this rate the new fuel is cheaper than kerosene in Paris, and should be here when its manufacture is perfected. The use of alcohol, whose materials are grown by any farmer, and cannot be monopolized, would free industry from the trusts which control both coal and oil. It may prove of great value to humanity everywhere."

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The Steam Boiler Injector.

This appliance, which was invented by Giffard, is in many respects the most peculiar and interesting apparatus connected with the steam plant. It is an instrument which converts the energy of the steam into mechanical work without the aid of any moving mechanism whatever. Before describing it, it is necessary for us to notice the difference between the velocity of steam escaping from a boiler and water issuing from the same boiler and under the same pressure of steam. It is impossible to compute this accurately within reasonable limits on account of the theory and the rules by which it is determined, but it is safe to say that for the pressure usual to land stationary boilers, the velocity of steam is from fifteen to twenty times that of water issuing from the same boiler.

Next, we will consider the steam discharge. Suppose that some of the steam was discharged from a boiler through a pipe at the usual high velocity it attains, and that while in the act of discharge it was suddenly condensed by passing through an intensely cold medium, it is plain that the resulting water condensed from the steam would travel forward with the same velocity which it had already acquired when in the state of steam, and if the noxious particles of water could by any means be gathered together into a continuous stream, they would be more than able to overcome and force back into the boiler any opposing stream of water of the same size directed against them from the water space or room of the boiler. Now, we see that the velocity of the condensed steam is so great that it possesses not only enough energy to re-enter the boiler in the face of an opposing stream of water of its own size, but it can also impart energy to a much larger mass of water, so that this larger mass can also enter the boiler.

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Liberality and its Reward.

Having concluded to abandon the general advertisements on the front cover of the PRACTICAL ENGINEER, a representative of this paper waited upon Messrs. E. F. Houghton & Co., who have occupied space upon the front cover for some time, with a view of getting them to take a similar space on the inside.

All of these visits to Houghton's place are pleasant, but this one was particularly so. Their general manager said that he would not only willingly give up the outside cover, but he would take an entire page on the inside. Whatever improved the paper in general, improved the advertisements.

The liberality of this firm and their plunging, hammering methods of doing business are so well known to engineers that it is scarcely necessary for us to dwell upon it; but what particularly struck our representative was the results of these methods, which were apparent at every turn.

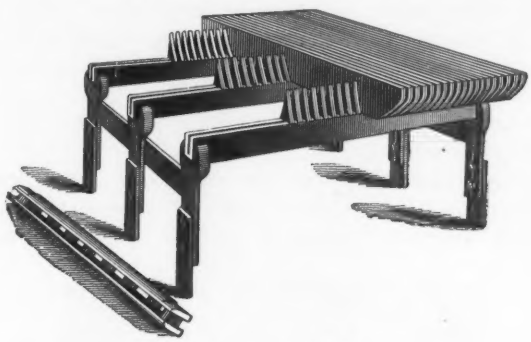
Busy correspondents at work till the click of some thirty odd typewriters made one think they were in a mill; closely applied accountants bending over their books till one would suppose they were in a London counting-house; clerks working upon mathematical problems with calculating machines; draughtsmen working upon original designs, and everything in apple-pie order and all running according to a system that is beyond the comprehension of the outsider, yet so simple that youths of both sexes seem to work in harmony with it without the slightest friction.

The shipping rooms presented a marvelous condition of affairs. Teams backed up to the loading platforms, others awaiting their turn, and supplies of all kinds packed up in excellent condition for shipment to all parts of the civilized world. And traps. Of course the representative of this paper was interested to see how many traps were going out, because this trap has been so extensively advertised, and particularly in the PRACTICAL ENGINEER. If all the Mark Steam traps in evidence of shipment upon the occasion of this visit came from readers of this paper, it would seem as if a large percentage of our subscribers had ordered at least one for shipment on this particular day.

The moral of all this is: Be liberal in business, and, above everything, be liberal to the engineers and they will not overlook you. This firm has never spent much time jollying the engineer, but when they have been called upon to do anything to aid the engineers as a class the very head of their concern has never been too busy to respond.

The American Adjustable Grate Bar.

Probably one of the best form of grate bars in use at the present time is the improved American adjustable grate bar manufactured by the E. J. Moore Machine and Foundry Co., 2227–2235 Wood Street, Philadelphia. This style of bar has many points of merit which will readily commend it to the user. The general method of construction is such as to make it at all times accessible at every point. The whole structure being composed of movable and interchangeable parts, and it is the only grate with an adjustable frame. This frame not coming in contact with the brick work, saves the walls from getting loose, and it being free at all points can be adjusted to any desired point. The perforated supporting cross bar has less obstruction to a free circulation of air than any other cross bar made. Another commendable feature is that the



The Longest-lived Grate Bar That Ever Lived.

Call Your Engineer's Attention To This Bar.

movable teeth between the grate bars can be easily changed at any time, so as to give an air space between the bars that is desired to accommodate any size of fuel; the movable teeth also give the bars more freedom to expand and contract, hence reducing the liability to warp to a minimum. The manufacturers will be pleased to send further particulars to anyone interested upon application.

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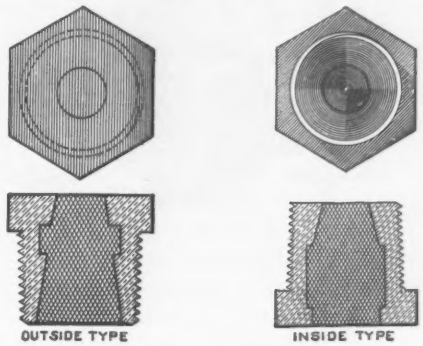
Fusible Plugs.

The recent action of the United States Treasury Department in enforcing the provisions of Section 4436 of the United States Revised Statutes, regarding the specifications as to the manufacture of fusible plugs, has attracted considerable attention to this article.

Fusible plugs have been used in boilers for a great many years, and the Government, recognizing the important function of this boiler accessory, requires that all plugs used on boilers of steam vessels should be made of bronze and have no other filling but pure Banca tin.

Many plugs have been offered on the market which are filled with fusible alloys composed of other metals, which, although melting at very near the same point as Banca tin, were not absolutely reliable. Since the disaster at Philadelphia last fall, the United States Steamboat Inspection Service of the Treasury Department has taken cognizance of the fact that inferior plugs were offered upon the market and issued a circular requiring that all fusible plugs should be filled with pure Banca tin and stamped with the manufacturer's name, and that an affidavit setting forth this fact should be filed with the inspector having charge of the boiler inspection at whatever point the plugs were used.

The Lunkenheimer Company have manufactured fusible plugs for a number of years, all of which comply with these specifications, and, having made affidavit before the United



FUSIBLE BOILER PLUGS.

States Steamboat Inspection Service to the effect that their plugs comply with these requirements, the same are accepted by all inspectors throughout the United States.

Herewith are illustrated two forms of plugs; namely, the outside and inside patterns, same to be screwed in either from the inside of the boiler or from the outside through the fire box or shell.

These plugs are manufactured by the Lunkenheimer Company, of Cincinnati, Ohio, who will be pleased to give further particulars upon application.

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The "Acton" Modern Automatic Valves.

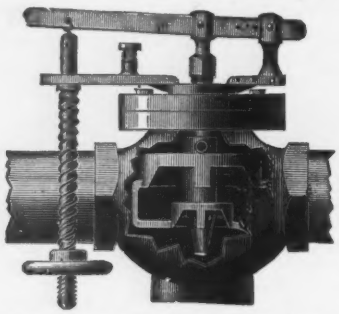
While there is a multiplicity of special valves upon the market for use in the many parts of an up-to-date steam plant, it will be well for the engineer to study which of the several devices he will adopt, in order that he may be sure of the best results.

The steam trade and its requirements has occupied the minds of many, but only few have really succeeded in perfecting suitable devices of real value; among these few is John Acton, 118 John Street, Brooklyn, New York. The Acton Special valves are largely in use and can safely be relied upon to work up to their guarantee. These valves are the outcome of over twenty years of actual practical experience, which is a fact worth recording.

The Acton Special valves comprise all of those devices in that line which have been found to be of practical use. The Acton Reducing valve probably has no peer, as is also the case with the Acton High-pressure reducing valve; besides the above-mentioned valves, the Acton High-duty ram pattern valve, the Low service reducing valve, the Acton Patent balance valve, the Acton Relief valve, the compound pump governor and the Acton back pressure valve will each appeal to the user as being an exceptional article of its kind.

The manner of construction and the mechanical perfection of the Acton valves can be noticed by a glance at the accompanying illustration, which shows a sectional view of the Acton back pressure valve. This valve is used for maintaining a uniform and differential pressure in steam heating apparatus, and, as will be seen by the cut, to be a specially differential seated valve controlled through a lever and adjustable spring.

The piston form of the disc makes this valve noiseless and hammerless under all conditions of steam pressure and use.



THE ACTON BACK PRESSURE VALVE.

Any required difference of pressure may be obtained by merely turning the thumb nut on the regulating spring and its closure stopped by a hair spring under the lever.

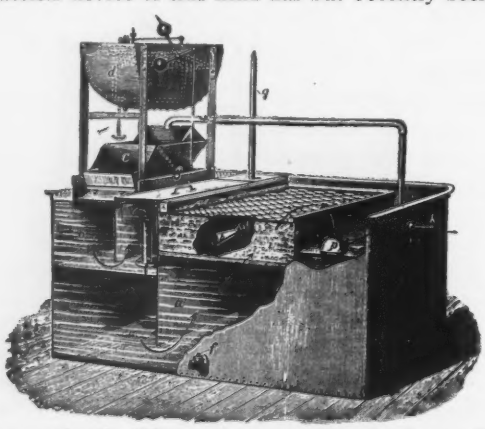
The same form of high-grade workmanship and perfection of mechanism maintains throughout the whole line of Acton valves. An inquiry addressed to the above number, will obtain for anyone a more complete description of these valves. The Acton catalogue will well repay anyone for the trouble taken to obtain it, being replete with interesting items of use to the engineer.

* * *

The Bruun-Lowener Patent Water-Softening Apparatus.

A very general request is for information as to how scales may be gotten rid of entirely in steam boilers. To this question there is only one answer, viz: prevent its formation by removing the scale forming matters before it ever reaches the boiler plates or tubes. All boiler users recognize the enormous expense, trouble and loss of heat caused by scale through using hard water, in addition to which the life of the boiler is shortened and danger of explosion greatly increased. It is a well-known fact that the consumption of coal is increased 30 to 35 per cent. where scale exists in a bad form.

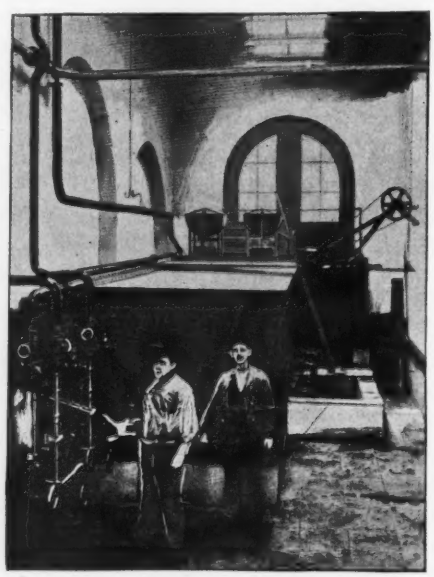
Knowing these facts steam users have for years tried all possible kinds of compositions, etc., to prevent formation of the same. The ideal system is to remove all such matter from the water prior to its entering the boiler. A most interesting and practical device of this kind has but recently been placed



upon the market in this country—namely, the Bruun-Lowener patent—operating under the name of the American Water-Softener Company, with headquarters in the Harrison building, Philadelphia. The title of the company is synonymous of its purpose. Recognizing the disadvantages of using hard water in boilers, this Company have adopted the most efficient method of softening it before it enters the boiler. Their apparatus, while new in this country, has been without question one of the most successful devices ever used for this purpose abroad. The many testimonials and its use by prominent manufacturers give it a standing well worth recording when making a study of a method of boiler cleaning.

The arrangement is so simple and ingenious that it will at once appeal to the user. The object of the machine is to eradicate absolutely all scale-forming matter which the feed-water may contain before it reaches the boiler. This is attained by the automatic introduction of a softening chemical. Through a practical arrangement a certain quantity of chemical is mixed with a certain quantity of water in order to precipitate the hard substances. The apparatus is so arranged that no matter what quantity of water is passing through the softener, the chemicals are always mixed in the right proportions. After the water has been properly treated, or, in other words, the solids precipitated, the water is run through a very effective filtering device, depositing in its course all of the precipitated matter, and thus effectually preventing all opportunity of it gaining ingress to the boiler.

After passing through the filter, the water passes into a tank, this tank is kept constantly supplied through the means of an automatic float valve which not only operates the water



SHOWING INSTALLATION OF APPARATUS.

supply, but indirectly controls the admission of the chemical supply, making it impossible to have a waste of this material or an over-supply of the same, a feature so often found in many devices used for this purpose. The accompanying illustration shows a sectional view of the apparatus; D is the receptacle containing the chemical used; C shows the automatic buckets which after receiving a certain portion of water and chemical is tripped automatically into tank B where the solids precipitate; from thence the flow is into the lower tank, then upwards through the filtering bed I into the reserve tank P. This tank has a float valve connection which regulates the inflow, thus always maintaining a supply of pure soft water. The cost of application and the certainty of gratifying results make this appliance well worth consideration. The Company

will be pleased to give more explicit information upon application for same. They will also be pleased to demonstrate its worth to anyone interested by an absolutely free trial; that they can afford to make this liberal offer is attested to by the hundreds of satisfied users.

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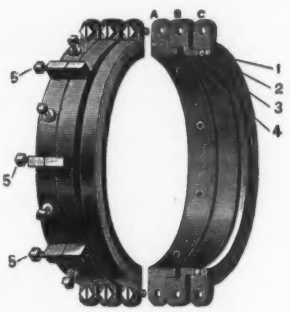
The Climax Steam Joint Clamp.

There is nothing more aggravating to the engineer than a steam-joint from which the steam is leaking. This is true for many reasons: first, the matter of expense incurred through loss, for undoubtedly a leaky joint will cause a loss of many pounds of water in a day; again, there is the ugly, unsightly incrustation resulting from the leak, but paramount to everything else, heretofore it has often become necessary to take down a whole set of piping to set in a piece where the leak has become too pronounced. While this feature may not seem very difficult in the matter of pipes of small diameter, when one considers the very great amount of labor and time necessary to expend in doing this work where the larger diameter steam-pipe is used, it at once becomes evident that any remedy showing anywhere near good results would be accepted with the greatest of pleasure, both by the engineer and the manufacturer. The very great need of some appliance which would effectively cure this evil and at the same time be inexpensive, and which could be applied while the pipe is under pressure, was appreciated by James McCrea & Company, 11 and 13 South Canal Street, Chicago, Ill.



The McCrea Company have placed upon the market the Climax Steam Joint Clamp. This clamp is not only effective in its work but it will appeal to the user in that it can be applied at any time and under all conditions with but little labor or time expended. Another feature of this clamp is its economy in the matter of price, the cost alone being repaid to the user in a short time in the matter of steam saved.

The accompanying illustration shows the clamp, and a glance at it will convince the most skeptical of its value.

The construction is such that anyone can attach it. The method of operation is to force directly over the leak a ring of packing in such a manner that precludes all possibility of leaks. This is obtained in the following manner: "A," rigid clamp with male thread held firmly to pipe by set of screws. "B," loose clamp with female thread, and lugs for spanner. When screwed away from, "A" forces with blank face packing through clamp "C" to joint. "C," loose clamp-holding packing and follower ring. 1 represents a ring of packing; 2 represents follower-ring; 3 represents blank face in "B"; 4 represents male and female threads in "A" and "B"; 5 represents spanner. The clamps are made in halves, held together by cap screws.

In making inquiry it is well to state whether they are intended to be used for steam, water, air, gas, or ammonia. They are equally efficient upon either, but require different conditions. The clamps are made in sizes up to 24 inches. A postal to the above-mentioned address will secure further explanation, prices, etc.

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The Weinland.

WATER POWER TUBE CLEANER.

The accompanying illustration represents the Weinland improved No. 8 Water Power boiler tube cleaner, which is said to be a marked improvement over those heretofore produced. The machine embodies the same general principles as other water power, ball-bearing cleaners made by this company. The improved machine, however, has been remodeled and has been made very much stronger than the other style. The spider to which the arms are attached is now almost solid, so that it will withstand the severe strain put upon the arms. The bearings, including the balls, are larger so that it runs with the least friction, and consequently is more durable. A new design of coupling is furnished with each machine; this coupling is a great improvement over former designs in this line. It holds the hose securely so that it will withstand any pressure which the hose will stand without any danger whatever of pulling loose, as so frequently happens with the ordinary bands used in attaching hose. This little device in itself is worth the price of the cleaner as compared with others because of the annoyance which may be avoided by its use.

The LACONDA MFG. CO., of Springfield, O., the manufacturers of this machine, will gladly write anyone who may be interested, giving them full particulars, etc., of this new cleaner or of the other styles which they make.

They also continue to make the former No. 1 Weinland water power, ball bearing machine which is so well known to the users of tube cleaners.

(See their ad. in this paper.)

TRADE NOTES.

Traps, Feed Water Heaters and Separators are appliances in which every engineer is interested. If any of our readers are not familiar with the Bundy specialties manufactured by the A. A. Griffing Iron Co., Jersey City, N. J., they should write at once for copies of their catalogues. These catalogues are handsomely printed and illustrated and contain a great deal of valuable information. They make a valuable addition to an engineer's library.

You will find in the catalogue issued by Mr. John Acton, 118 John St., Brooklyn, N. Y., a variety of special appliances which will interest all engineers. A postal card mentioning this paper will bring you one.

A Piece of the scale from your boiler, sent to Geo. W. Lord, 2238 N. 9th St., Philadelphia, will give you a perfect analysis of its composition. The information is certainly worth more than the trouble of sending the sample. (See last page.)

A New Catalogue has been received from the Lee Injector Mfg. Co., 103 Abbott St., Detroit, Mich., which we take much pleasure in recommending to those of our friends who are interested in Injectors and who want something useful rather than ornamental. It contains several tables, giving such information as horse-power of boilers, temperature of metals by fusion saturated steam; and an article on Injectors by W. O. Lee, which is very instructive. It also contains pictures of some of the oldest steam engines, as well as the most modern types. A postal card or letter mentioning this paper will bring you a copy.

Electrical Repairs are often a source of much worry to engineers, the trouble comes from the difficulty of having this class of work done well without sending the machines away and usually paying an extortionate price in addition to the oss by delay. This, however, is now one of the troubles of the past, for right here in Philadelphia we have one of the best equipped electrical shops in the country, centrally located, and making a specialty of repair work of all kinds, everything in the line, nothing too large or too small, and done without delay. This is the Electro Dynamic Co., 212 Ionic St. Mr. J. H. Lamb is in charge of the repair department and he will be pleased to call upon you or write you any information desired.

Every body wants Pumps these days for some sort of service. The Barr Pumping Engine Co., Germantown Junction, Philadelphia, make every type of steam pump, from a bell driver for boiler feeding to the largest types for water works service, in each of which is combined excellence of workmanship and material, with moderation in price. They have a handsome catalogue which they will send upon request, or if in Philadelphia, call at their down town office, 55 N. Seventh St., and see Mr. Al Burns.

The Pittsburg Gauge & Supply Co., 308 Water St., Pittsburg, Pa., has recently shipped four White Star Oil Filters to the Yarbii Mines, Japan. G. F. Dumler, manager of their Philadelphia office, 1011 Girard Trust Bldg., reports large recent sales of White Star Filters.

The Liberty Mfg. Co., 5988 Centre Ave., Pittsburg, Pa., inform us that they have recently received numerous large orders for their Turbine Cleaners for Water Tube boilers, which they look upon as the best indication of the superiority of their Cleaner. If interested, write them for further information.

A well known chief engineer of one of the largest plants in America writes: "I have had a large and varied experience with nearly all classes of sheet packings. I want to congratulate you on the production of Garlock's Perforated Metal Insertion Sheet Packing which I have used on flanges, joints and unions with perfect satisfaction in every case. Have used it on three refractory joints which had given a great deal of trouble and on which all other packings used had failed. These joints have been made for many months and none of them show the least sign of leakage, although exposed to the cold air. Have recommended your Metal Insertion Sheet Packing to many of my fellow engineers. They also report perfect satisfaction in every case."

We will be pleased to send a sample and catalogue to any engineer on application. The Garlock Packing Co., Palmyra, N. Y.; branch offices in the principal cities of the United States.

The Crane Company, Chicago, are presenting to the trade their 1902 catalogue illustrative of the multiplicity of articles invaluable to the steam user, which they manufacture. It embraces in a most pleasing manner, both pictorically and typographically, their full line of valves, fittings, steam specialties, engineers' supplies, etc., for the ordinary pressures. Containing over 350 pages of descriptive matter of almost every one of the multiplicity of articles which are of daily necessity to the steam plant, this catalogue will be both instructive and interesting to any one interested in that line.

In addition to this elaborate work they also have issued special catalogues, namely, one for extreme high pressure up to 250 pounds, and one for hydraulic pressures up to 800 pounds.

These catalogues will be sent upon application to any of the Company's branches, or to the home office, Jefferson, Randolph and Desplaines Sts., Chicago, Ill.

"Eastwood" is the title of a very elaborate descriptive catalogue of the large and varied stock of valves, special fittings, copper tanks, etc., manufactured by the Eastwood Wire Manufacturing Company, Belleville, N. J. The book is replete with information which any engineer will find valuable to him. The Company will be pleased to send one to any engineer, only asking in return an acknowledgment of its receipt that they may in that way identify their friends and thus be in a position to send souvenirs on other articles of interest which they frequently have for that purpose. A postal to the above address will secure you one of these handsome books.

Cross Oil Filters Do Best

What other filters do well. They clean waste oil and drippings perfectly, making it fit for use over and over again Guaranteed to reduce lubricating oil bills at least 50%.

Nine governments have adopted them. Their sale has reached 28 different countries. They were awarded highest medal at the Pan-American Exposition.

Sold on 30 Days trial Shall we send one?

THE BURT MFG. CO., Akron, Ohio, U. S. A.
Largest Manufacturers of Oil Filters in the World
Cross Oil Filters carried in stock by the
FAIRBANKS CO.,
Sole Agents for Philadelphia

THE POSITIVE EXPANSION BOLT

Special Discount to Jobbers. Write for Prices

Manufactured by D. C. SEAMAN & CO.
1638 Hutchinson St., Philadelphia, Pa.
For sale by Neal & Brinke, 18 Warren St., New York; Somers, Fiths & Todd Co., 323 Water St., Pittsburgh, Pa.

IF ENGINEERS will send $1.00 to the address below they will receive two blue prints, with tables and instructions, showing how to set valves and eccentrics on Corliss engines, simple and compound, with one and two eccentrics. JOHN T. LINDSTROM, 440 Liberty Street, Allentown, Pa.

DO YOU KNOW

That we manufacture chemical water purifiers that are guaranteed to prevent and remove incrustation in steam boilers, no matter what its composition may be.

CHEMICAL PURIFIERS

that do this without injury to the boiler, its fittings or connections;

CHEMICAL PURIFIERS

that can be used with perfect safety in Breweries, Ice Plants, Dye Works and all places where the water of condensation is used for any purpose.

Write for terms, reports, circulars, etc. We interest you and pay liberal commission. Agents wanted everywhere.

THE PEERLESS SPECIALTY CO.
1720 N. 5th St. and 1711 N. Randolph St.
Philadelphia, Pa.

If any of our readers have trouble with water, scum or dirt lifting with their steam and cutting their cylinders interfering with lubrication or endangering a head, they should write to Mr. John T. Lindstrohm, 440 Liberty St., Allentown, Pa., telling him the exact conditions.

Engineers having water tube boilers in their charge and having trouble to keep scale out of them should write to the Lagonda Mfg. Co., Springfield, Ohio, for information about their new cleaner.

One difference between the ordinary soldered oil can, torch or bucket, and the steel-brazed kind made by the Sands Mfg. Co., corner of Market and Bayard Sts., Allegheny, Pa., is that the latter are practically indestructible. If your oil is cold you can set them in the fire, in fact, practically burn them up without danger of the seams giving way or leaking. A catalogue, describing many styles, will be sent to any one interested.

A new Reeves Engine Co. has been organized at Trenton, N. J., with a capital stock of $400,000. They will take over the plant of the old company, to which will be added new building and additional machinery. Mr. Clifton E. Reeves, member of A. S. M. E., and inventor of the Reeves engine, is president.

The ability of the American engineer to design steel structures of great strength and pleasing architectural effect, is shown in the eight half-tones on the handsome souvenir mailing card issued by the Joseph Dixon Crucible Company, of Jersey City, N. J. The card is a piece of artistic advertising on the part of the Company, and will prove of decided interest to constructing engineers and architects, to whom it will be sent on request.

Dixon's Silica-Graphite Paint, which protects these structures from corrosion, has been very extensively used in the south, west and sea-coast sections of the United States, also in Mexico, Australia, China, Japan. West Indies and Philippine Islands, and has proven its protective and wearing qualities in all climates.

A free sample for the purpose of testing the quality of Pulver Lubricating Compound will be sent to any reader of THE PRACTICAL ENGINEER free of charge, if interested. Address, Peter Pulver & Sons, 214 Franklin St., New York City.

The Pilley Expansion Flue Brush is now the most generally used device on the market for cleaning flues. The Pilley Expansion Wedge Packing is also said to be meeting with great favor. A feature in connection with a trial of this packing is that the makers cut and mould it into rings to fit your rods, without extra charge. For additional information address Pilley Packing and Flue Brush Mfg. Co., 308 W. Main St., St. Louis, Mo.

McGovern & Smith, 2054 East Lehigh Ave., Philadelphia, are expert boiler makers. They make a specialty of repairing boilers, tanks, etc. If any of our readers are in need of such service they will do well to give this firm a trial.

A Steel Packing Rule specially made for measuring packing and said to be worth $1 will be sent to any engineer, free of cost, with a trial order of "P. P. P." Packing. Address, Quaker City Rubber Co., Philadelphia. Mention THE PRACTICAL ENGINEER.

BOWERS BROS. & CO.

Contracting Engineers for HEATING and VENTILATION SYSTEMS, by Steam or Hot Water. FAN SYSTEM. PIPING POWER PLANTS.
Also Manufacturers of GRATE BARS of all descriptions. GENERAL CASTINGS.

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LICENSES

YOUR BELTS

YOU DON'T WANT TO RUN TIGHT BELTS. DO YOU?

YOU HAVE TO. WE KNOW YOU DON'T BELIEVE IN BELT DRESSINGS.

WE DON'T BLAME YOU.

BUT YOU WILL BELIEVE IN CLING-SURFACE If you will investigate what it will do.

It penetrates a porous belt and leaves the surface clean—not sticky.

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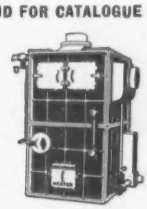

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DECLARATIONS OF PRINCIPLES

Believing that ability will bring its full value in this country, this Order shall at no time take part in strikes, nor in any way interfere between employer and employees. Recognizing their identity of interests, it shall take no part in any project or enterprise that shall interfere with perfect harmony between them ; neither shall it be used for political or religious purposes.

These principles shall not be amended or repealed except by unanimous vote of the Order.

Any member who shall be guilty of violating the principles of the Order shall be expelled.

OBJECTS.

First.—To promote a more thorough knowledge in its members of theoretical and practical steam engineering.

Second.—To assist members to obtain employment.

Third.—To help the sick, injured and distressed and bury the dead.

Fourth.—To establish a Widows' and Orphans' Fund.

Fifth.—To help members who shall become incapacitated from following the profession to obtain employment suited to their affliction.

Sixth.—To do our utmost to extend the license law throughout the United States.

Seventh.—To establish schools in which our members may study the highest branches of steam engineering.

MEMBERSHIP.

An applicant for membership must be an engineer between twenty-one and fifty years of age, and must be a white male citizen of the United States, of good moral character and be a believer in the Supreme Being, and be free from all physical infirmities.

He must have had three years' service in an engineering department, or if a machinist, or graduate of a technical institute, then, one year's service, in such department, and in localities where engineers are required by law to be licensed, they must have such license, and must satisfy the investigating and examining committees of the council to which he applies as to his character and ability.

LIFE MEMBERSHIP.

Engineers who have passed the age limit may be admitted to life membership. They must possess the same qualifications and pass the same examination as are required in the next proceeding clause : They shall be entitled to all rights and privileges of the Order except they cannot vote on financial questions or for the election of officers or be entitled to any sick or death benefits.

DIRECTORY.

The Publication Committee of "The Practical Engineer" desires that the Corresponding Engineers of all Councils of the American Order of Steam Engineers send the name of their Chief Engineer and their own name and address, together with the time and place of meeting to the Secretary of the Publication Committee immediately after each election of officers. Address J. C. McDowell, Secretary, in care of "The Practical Engineer," 1215 Filbert Street, Philadelphia.

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Energy Council, No. 2, meets every Wednesday of each month in Bauer Hall, Cheaspeak and Elliott Sts. Chief Engineer, Philip A. Kirkwood. Corresponding Engineer, Jos. H. Stallings 3032 Dillon St.

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Boston Council, No. 4, meets 2d and 4th Thursday of each month in Templar Hall, 724 Washington Street. Chief Engineer, Harry G. Black. Corresponding Engineer, Wm. T. A. Faulkner, 41 Worcester St.

Orange.

Orange Council, No. 9, Meets 2d and 4th Fridays. Chief Engineer, Chas. Gartrell; Corresponding Engineer, Fred. L. Hale.

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Old Colony Council, No. 14, meets second and fourth Saturdays in the American Foresters' Hall. Chief Engineer, E. H. Naylor. Corresponding Engineer, James K. Sedgwick P. O. Box, 333, Rockland, Mass.

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Stevens Council, No. 1, meets third Saturday, at Water, near Lafayette Street. Chief Engineer, Lawrence Oliver. Corresponding Engineer, James H. White.

Camden.

Camden Council, No. 3, meets every Thursday evening at N. E. corner 2d and Federal Street. Chief Engineer, S. R. Middleton. Corresponding Engineer, C. H. Pfeiffer, 571 Berkley St.

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Bridgeton Council, No. 5, meets every Friday. Chief Engineer, David Sellers. Corresponding Engineer, Francis O. Garrison, Bridgeton, N. J.

Millville.

Millville Council, No. 6, meets every Saturday, 7.30 p. m., in G. A. R. Hall, East Main St. Chief Engineer, Geo. Esabel Corresponding Engineer, Lewis Doughty, 604 Mulberry Street.

NEW YORK.

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John E. Sweet Council, No. 6, meets Monday, Room 23, Nottingham Block, East Washington Street. Chief Engineer, John Cunningham. Corresponding Engineer, S. A. Steel, 311 Orange street.

PENNSYLVANIA.

Grand Chief Engineer, Hiram Trout, 1105 North Tenth street, Reading, Pa. Grand Corresponding Engineer, Frederick Markoe, 931 Orianna street, Philadelphia.

Philadelphia.

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Welcome Council, No. 2, meets every Friday, N. W. Cor. 12th Street and Columbia Avenue. Chief Engineer, Paul Pieling. Corresponding Engineer, L. D. Woodington, 2428 N. Bancroft St.

Kensington Council, No. 3, meets every Thursday, at A. P. A. Hall, Frankford Avenue and Master Street. Chief Engineer Wm. C. stolt. Corresponding Engineer, Charles Fournier, 3115 Richmond St., Philadelphia.

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(Continued on page 26.)

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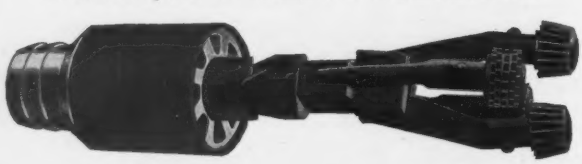

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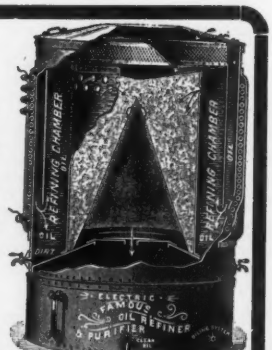

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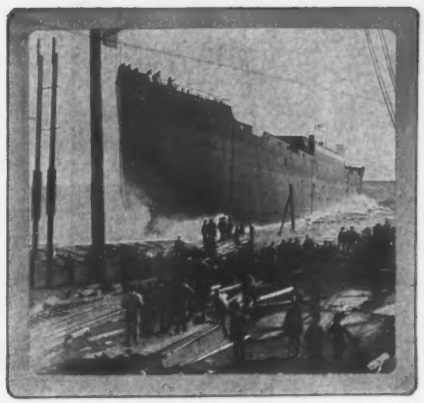

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Manayunk Council, No. 9, meets second and fourth Friday evenings in Temperance Hall. Chief Engineer, Richard Wallace. Corresponding Engineer, John Clevenger, 211 Lofty Street.

Helping Hand Council, No. 12, meets every Tuesday evening at Jasper and Huntington Streets. Chief Engineer, Thos. Evans. Corresponding Engineer, Frank McHugh, 2503 Tulip St.

Municipal P. F. D. Council, No. 20, composed exclusively of engineers of Philadelphia Paid Fire Department, meets quarterly at Girard Hall, Girard Ave. above Sixth. Chief Engineer, Frederick Markoe. Corresponding Engineer, Walter Meyers, 1211 North Howard Street.

Pittsburg.

Iron City Council No. 21 meets every Saturday at 1070 Fifth Avenue. Chief Engineer, M. J. O'Sullivan. Corresponding Engineer, John Mc. F. Easton, 127 Yard Street, S. S.

Girardville.

Girard Council, No. 8, meets every Tuesday evening at O'Neill's Hall, 2nd and Ogden Sts. Chief Engineer, Jacob Weber. Corresponding Engineer, M. J. Carey, Lock Box 214.

Allentown.

Lehigh Council, No. 15, meets every Wednesday evening at 639 Hamilton St. Chief Engineer, Jacob Donnecker. Corresponding Engineer, A. P. Driesbach, 728 Chew Street,

Pottstown.

Pottstown Council, No. 14, meets first and third Saturday evening at P. O. S. of A. Hall. corner High and Hanover Sts. Chief Engineer, Joseph Rhoads, Corres., Engineer, H. L. Shirey, 392 Cherry St.

Reading.

Progress Council, No. 13, meets every Saturday evening at Diebert Hall, 9th and Penn Sts., Room 4. Chief Engineer, Frank S. Miller. Corresponding Engineer, James M. Fisher, 1224 Oley St.

Chester.

Delaware County Council, No. 6, meets every Wednesday evening in the Carpenter Hall, 6th and Wall St. Chief Engineer, John Canavan. Corresponding Engineer, E. E. McCoy, 2222 West 3d Street.

York.

York Council, No. 16, meets every Wednesday evening in the Jordan Block. Chief Engineer, F. Seyler. Corresponding Engineer, Walter H. Long, 23 East Philadelphia Street.

Harrisburg.

Capitol City Council, No. 17, meets every Tuesday evening in Red Men's Hall, Market Street, above Second. Chief Engineer, B. H. Shafer. Corresponding Engineer, S. Filson, 1126 Market Street.

Columbia.

Columbia Council, No. 18, meets every first and third Saturdays, in Bittner's Hall. Chief Engineer, R. K. Grosh. Corresponding Engineer, W. J. Courtney, 804 Walnut Street.

Sunbury.

Sunbury Council, No. 19, meets every second and fourth Thursday in Zartman's Hall. Chief Engineer, Aaron Buck. Corresponding Engineer, Ed. Schrieber.

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Deputy Supreme Chief Engineer, Joseph P. Harris, No. 1611 Clybourn Street, Milwaukee.

Milwaukee.

Washington Council, No. 1, meets every Saturday at 207 Grand Avenue. Chief Engineer, J. B. Chambers. Corresponding Engineer, James A. Rigby, 136 Reed Street.

Clifford P. Williams Council, No. 2, meets every Thursday evening 298 4th Street. Chief Engineer, David T. Richardson. Corresponding Engineer, Jas. T. Harris, 1611 Clybourn Street.

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Deputy Supreme Chief Engineer, John B. Mullen, 826 Central Ave., Nashville.

Nashville.

Enterprise Council, No. 1, meets every Friday evening in the Twin Building on Cedar St. Chief Engineer, J. J. Johnson. Corresponding Engineer, Jno. B. Mullen, 200 Jackson Building.

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Deputy Supreme Chief Engineer, Benjamin F. Myrick, P. O. Box No. 1. Grant's Pass, Oregon.

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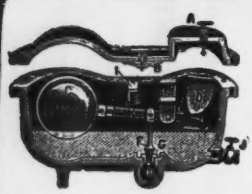
Galveston.

Galveston Council No. 1 meets every second and fourth Tuesday evening at Engineers Hall, So. West corner 22nd and Strand Streets. Chief Engineer, Max Levy; Corresponding Engineer, A. L. Bradford, Union Depot.



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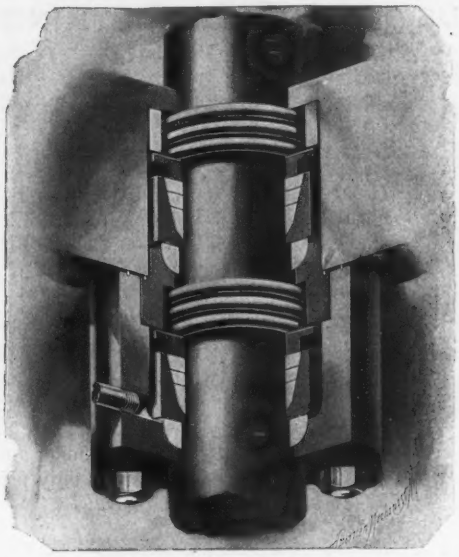

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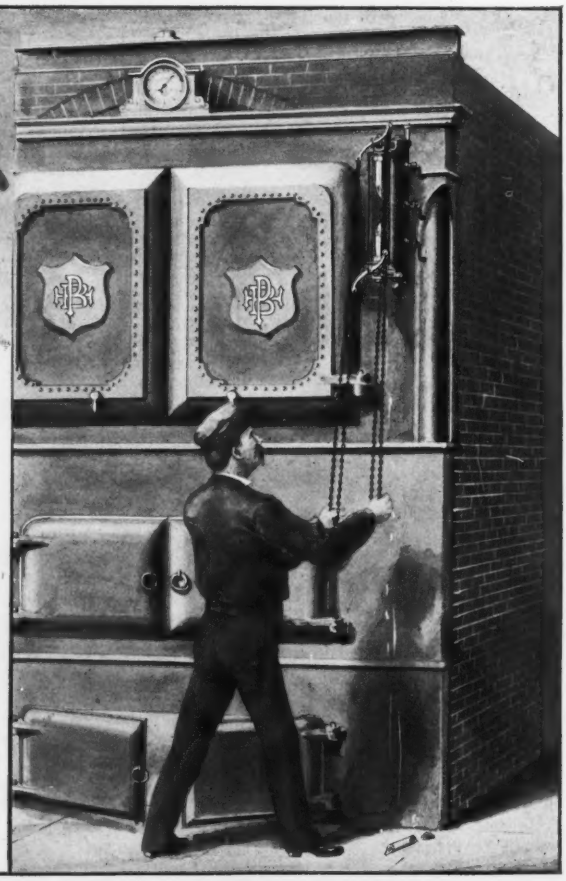

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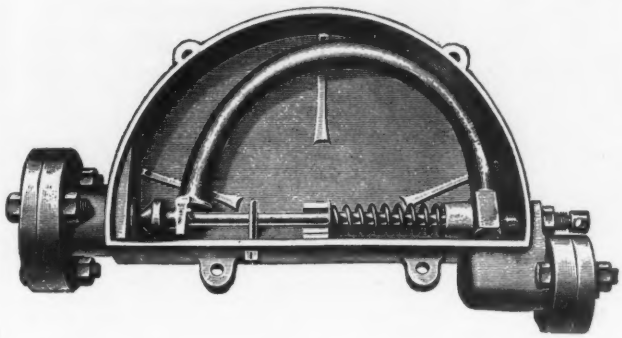

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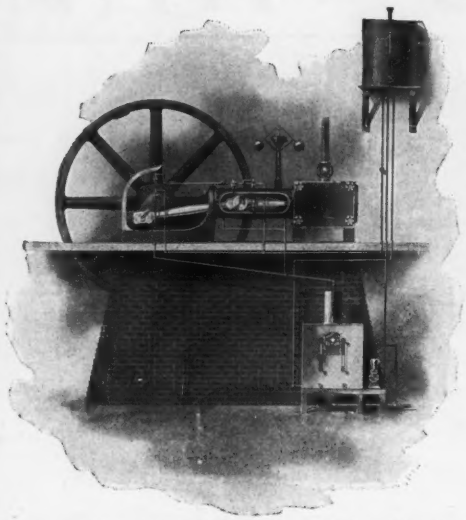

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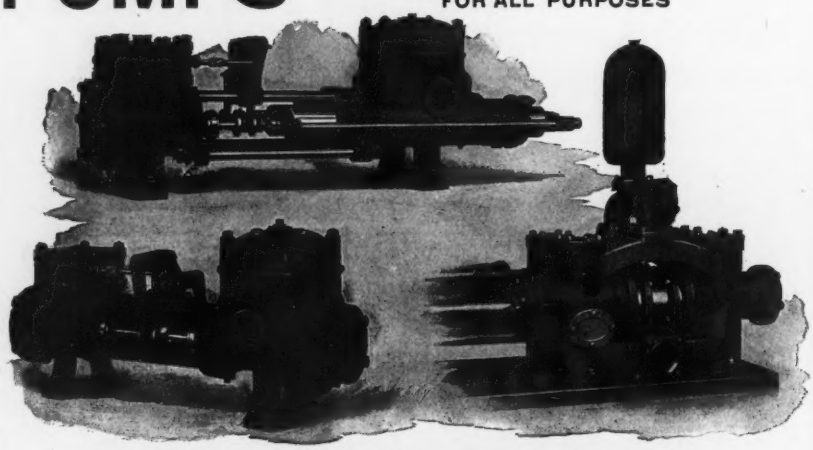

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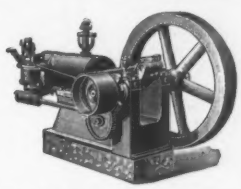

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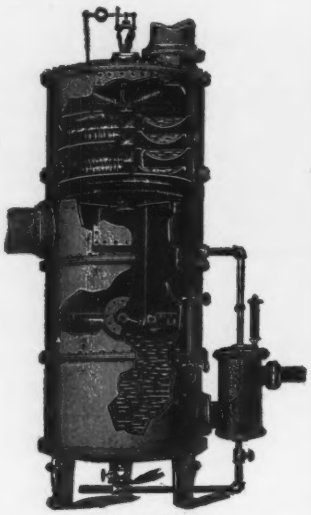

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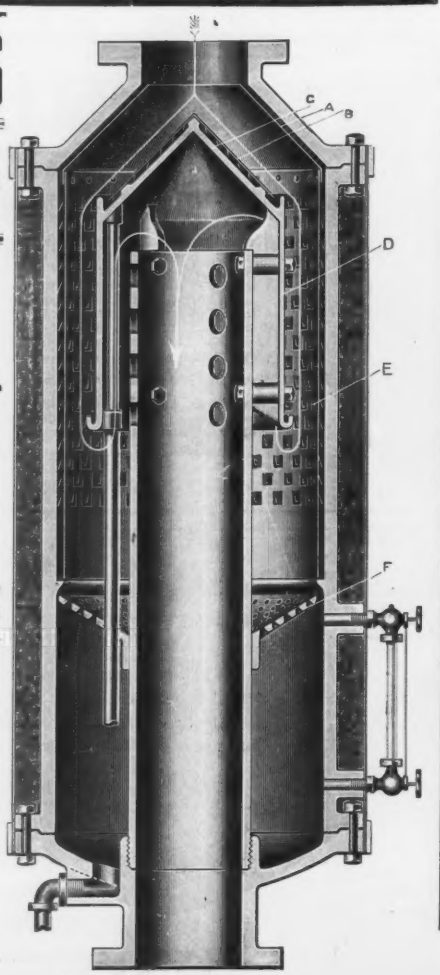

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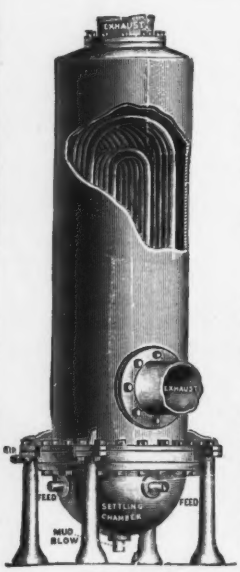

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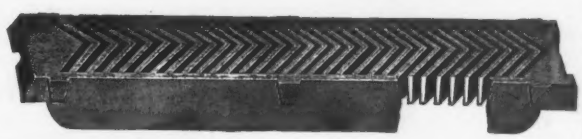
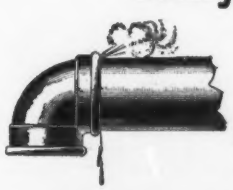
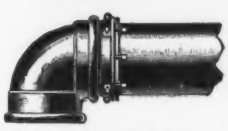


Frick's Pipe Clamps for Stopping Leaky Pipe Joints





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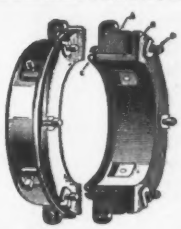

A—Outside or main ring which is bolted around the pipe as close to leaky joint as possible, and secured to pipe by the setscrews.
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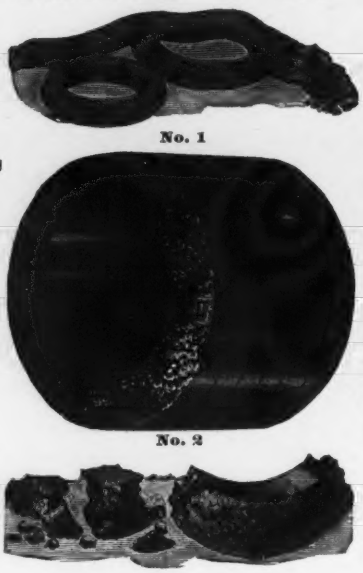

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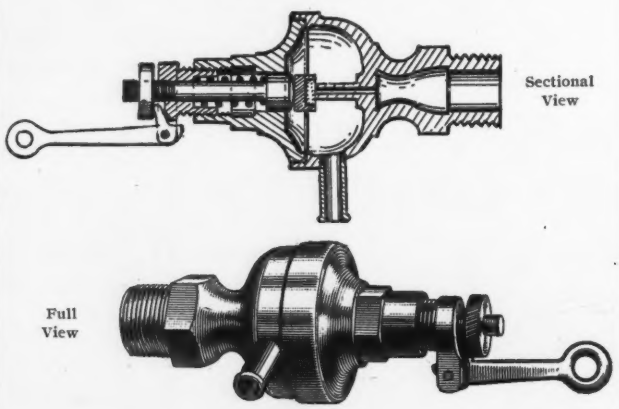

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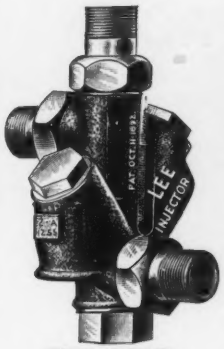

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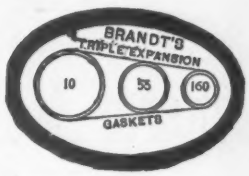

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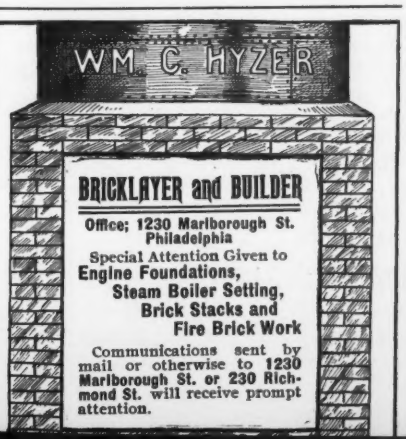
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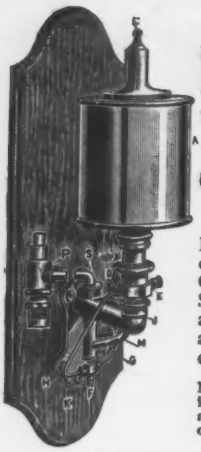

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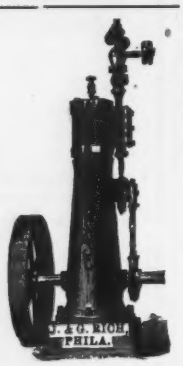

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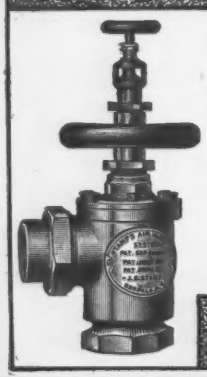

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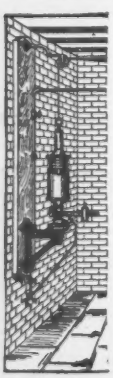

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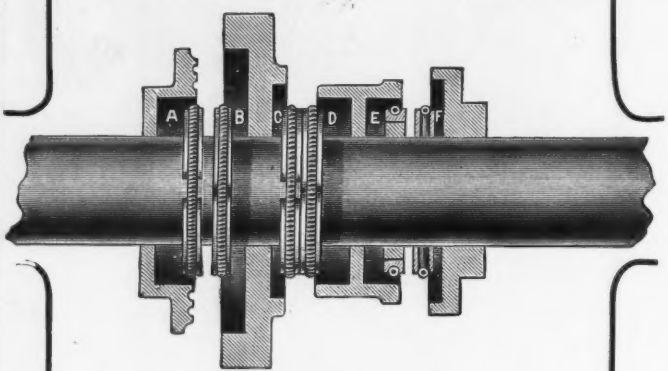

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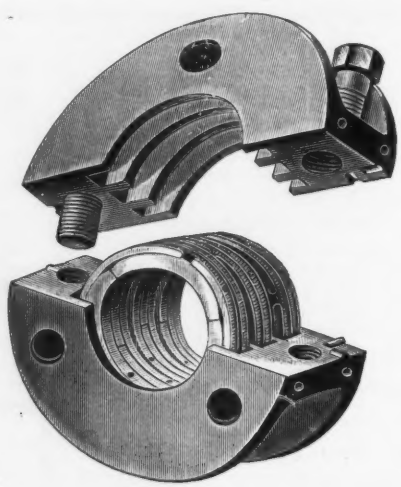

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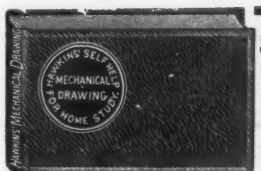

Learn to Draw. This book, as shown in illustration, is a self-instructor for home study and practice in the art of Mechanical Drawing for Engineers, Machinists, Electricians, Metal Workers and all interested in Drafting for shop practice, and has been prepared in plain practical language, and illustrated, by the author of "Hawkins' Educational Works." The book is divided into 28 different subjects which comprise the fundamental principles of drawing, each heading being thoroughly treated. There are 320 pages, 300 illustrations and diagrams. The book is handsomely bound in green cloth, gold edges and titles, size 7 x 10½ in., printed on fine paper. Upon receipt of $2 the book will be sent to any address prepaid, money returned if not as represented, order today; see order coupon.

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Enclosed find Two Dollars, for which ship me at once one copy of Hawkins' Mechanical Drawing.

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Builders of Boilers, Tanks and all kinds of Wrought Iron Work

For the past ten years we have made a specialty of self-supporting steel stacks and large tanks. We solicit a trial from the trade and are sure that we can benefit you in price.

Radcliff, Ferguson Co.
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Important to all Applicants for a License

Garlock Belt Preservative

is different in all respects from any other on the market.

The use of a Belt Dressing should be for two purposes: First to preserve the belt, and second to prevent slipping. Many of the dressings will accomplish one of these objects but GARLOCK BELT PRESERVATIVE not only preserves and makes the belt pliable, but prevents slipping.

It adheres to the belt and does not coat the pulley.

It never hardens.

It is a Liquid and goes into the pores of the belt.

It is put up in one quart tin cans of convenient size to handle.

Its lasting qualities are wonderful and a very small quantity will do the work.

If you have never used it and wish to try it, a sample can will be sent by mail free of charge upon receipt of your request.

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604 Arch Street, Phila., and all other branches

There's a Hot Time Coming

June, July and August are usually hot months, and with them comes the dripping, splashing and running away of your oil, which is not only dirty and disagreeable for the engineers, but is a source of extravagance.

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does not melt and run away, but remains the same under all temperatures, always pliable enough for good service, and with a perfect body that prevents dripping and waste.

Try it for yourself.

A large sample of Keystone Grease sent free, with brass cup, prepaid.

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Registered.

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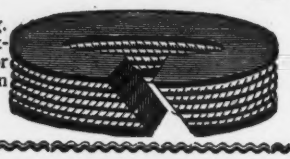
Self-lubricating, Steam and Water Tight, Less Friction than any other known packing. **None Genuine Without This Trade Mark Stamped on Wrapper.** All similar packings are imitations. In ordering give exact diameter of Stuffing Box and Piston Rod or Valve Stem. Our Packing is a sure cure for leaky stuffing boxes, whether the motion is rotary or reciprocating.



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Vacuum Valve for Condensing Plants

CHOICEST OF ITS CLASS

Some Specialties: *Pump Governors, Reducing Valves, Back Pressure Valves, Condensing Engine Relief Valves, Heavy Duty Valves, Damper Regulators, Steam and Water Separators, Receivers for Returning Condensation, Thermostat Controllers, Water Works Reducing and Relief Valves. Water Filters, Remove all Sediment.*

Any Mechanical Question will be Answered for Intending Purchasers

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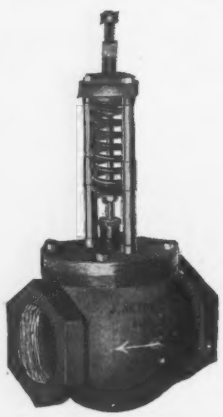
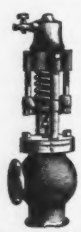


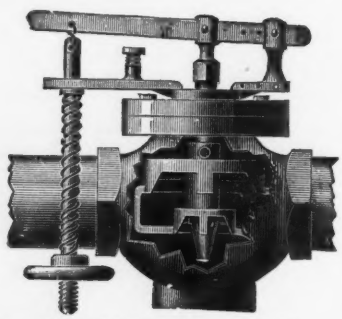
Sensitive Relief Valve

Nelson's Filter and Oil Collector

Send for Catalogue



Pump Governor



Compound Back Pressure Valve Excelled by none

STOP THAT **DRIP, DRIP, DRIPPING!**

BONAR GAUGE COCKS

have been used in some of the largest steam plants in the country for the last ten years. There is nothing to wear out except the disc, which CAN BE RENEWED WHILE THE BOILER IS UNDER FULL PRESSURE. It merely takes a few minutes along with a few cents to renew the disc, and after the same is renewed you practically have a new gauge cock, and you don't have to wait until Sunday to renew it either. They are a boon to busy engineers, for they save annoyance and trouble, not to speak of Sunday or night work. Ask any engineer who has used them. They are also a boon to the men with the money, for they save many pounds of steam that would otherwise go to waste, inasmuch as a steam plant cannot be shut down to regrind a leaking gauge cock. Let us send you a set to try.

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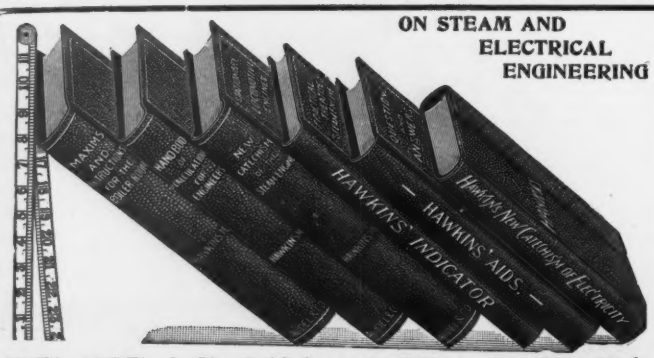
We also make **BONAR OIL FILTERS**

Send for our book on **STEAM APPLIANCES**

ON STEAM AND ELECTRICAL ENGINEERING



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It's the Packing that's always reliable for all purposes—costs less at first—lasts much longer—is frictionless—develops more power—always the red diamond on label

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This no doubt refers to our Instruments.

We invite a suit and guarantee to users of

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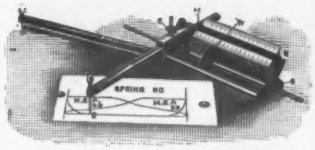
Full protection against liability.



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Jas. L. Robertson & Sons, 205 Fulton Street, New York

40 Per Cent Saved

PILLEY'S EXPANSION WEDGE PACKING

See that this trade mark is on all Pilley's Packings

THE ONLY PACKING HAVING A PERFECT EXPANSION AND PRACTICAL WEDGE
MADE IN 12-FOOT LENGTHS OR

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TO FIT YOUR RODS

This is the most economical wedge packing on the market, and as it is not **loaded** with **unnecessary** Oil and Tallow it weighs about one-half per foot of other wedge packing, thus making a saving of fully 40 per cent in cost of packing

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PILLEY'S IMPROVED RING PACKING

Sent on Thirty Days' Trial to Responsible Parties

Latest and Best

Showing Construction of Brush

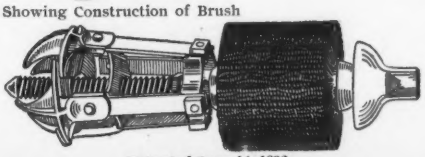
Brush ready for use

A RECORD FOR RELIABILITY IS BEHIND THE IMPROVED

Pilley Expansion Flue Brush

It Is Guaranteed Not to Break, Being made of Malleable Iron and Tempered Steel

It Cleans the Entire Flue Every Time it is Pushed Through



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Keep your tubes clean and save money. **Pilley's Combination Flue Brush and Scraper** is the simplest and best cleaner on the market. A simple turn of the hand adjusts it to the tube and the brush removes what the scraper loosens. Guaranteed not to break nor the wires to come out or lay over. Sizes from 2 inches up. Measure outside diameter of tube.

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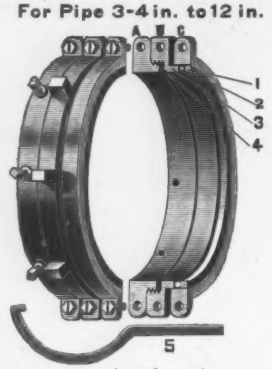
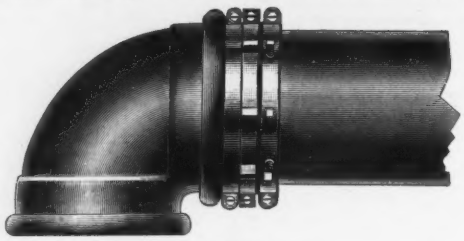
The Climax Steam Joint Clamp

For repairing LEAKS at joints where pipes are screwed into fittings Made of Brass. All Sizes, from 3-4 inch to 24 inch. In 2 styles

C. S. J. CLAMP, No. 1.
For Pipe 3-4 in. to 12 in.



1 Represents a ring of packing.
2 Represents follower ring.
3 Represents blank face in "B."
4 Represents male and female threads in "A" and "B."
5 Represents spanner.



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Attached in a few minutes without shutting down the plant, making a permanent and economical repair.

Eastern Agents who carry a complete stock always on hand.

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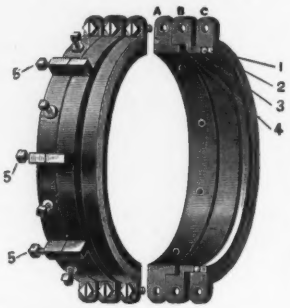
C. S. J. CLAMP, No. 2.
For Pipe 8 in. to 24 in.



1 Represents a ring of packing.
2 Represents follower ring.
3 Represents blank face in "B."
4 Represents piston guide in "A" and "B."
5 Represents set screws for forcing "B" from "A."

JAMES McCREA & CO., MANUFACTURERS

67 W. WASHINGTON ST. - - - - - CHICAGO

ATLAS ENGINES and BOILERS

The Operating Engineer, the man who stands by the throttle day after day, is the man that knows whether an Engine is good or bad

From a Man that Knows

LORAIN, OHIO, May 15, 1902

Atlas Engine Works,
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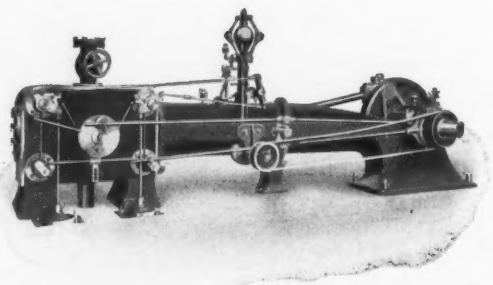
Dear Sirs:—Please send me a catalogue of your Corliss and Automatic cut-off engines and a blue-print of your Corliss valve-gear if you have it.

In the plant I am at we have six engines, two of them are your Automatic cut-off engines, and can say they are run 250 per minute at an average of 14 hours per day, and are durable, economical, smooth running machines.

Thanking you in advance, I remain

Respectfully yours,

WM. CONGDON
Engineer, Ship Yard.



Atlas Girder Frame Corliss

CATALOGUES FOR THE ASKING

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PHILADELPHIA GREASE

A Lubricant of Superlative Quality

Sample and Cup, Free of Cost

THE PHILADELPHIA GREASE MFG. CO.

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The WEINLAND Tube Cleaner

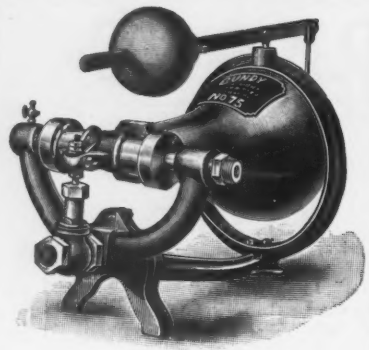
CLEANS TUBES CLEAN

It is the machine for you, if *effective work, strength* and *minimum cost of operating* count for anything

SAVES TUBES, TIME, COAL, LABOR AND INCREASES DIVIDENDS

The Patent Coupling shown above is worth your consideration. One goes with every cleaner. Hose can't pull out. Saves lots of time, worry and "cuss-words." Write us about Boiler Cleaning. We're experts in that line, have had 20 years' practical experience and "know how." Many sizes and styles of cleaners for all kinds of tubes.

The Lagonda M'f'g Co., 17 West Washington Street SPRINGFIELD, OHIO, U. S. A.



Most Engineers Know

A CHEAP TRAP is worth no more than it costs, and a good trap costs no more than it is worth. Take the **Bundy Steam Trap** for example; it costs more than some, but it is really the only always reliable Trap on the market

A. A. Griffing Iron Company

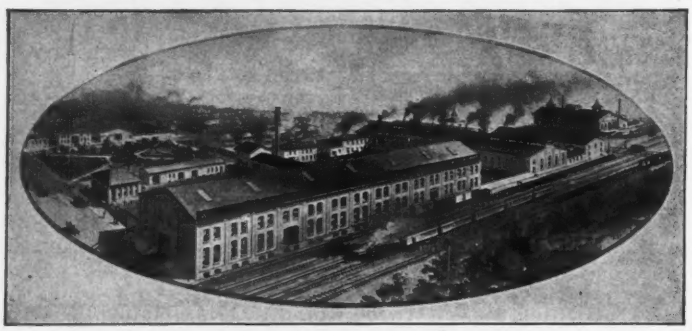
New York Boston Philadelphia Jersey City

Send for large Catalogue P. E. about Bundy Steam Specialties
THEY ARE ALL GOOD

WILKINSON AUTOMATIC STOKERS

Insures the Highest Degree of Economy made possible BURNING ANY KIND OF FUEL

Over 3000 Machines in Actual Operation



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Contracting Engineers, Iron Founders and Machinists BRIDGEPORT, MONTGOMERY COUNTY, PA.

KEYSTONE
Tri-Sodium Phosphate
and
Boiler Compound

Absolutely prevents the formation of scale and corrosion in boilers and on boiler tubes, and removes any scale already deposited without injuring the boiler in any way.

We guarantee to accomplish these results or accept no pay.

Send for book "Worth Knowing"—free. Or better still, send us a sample of your feed water; we will make analysis free of charge and report cost of keeping the boiler clean in your special case.

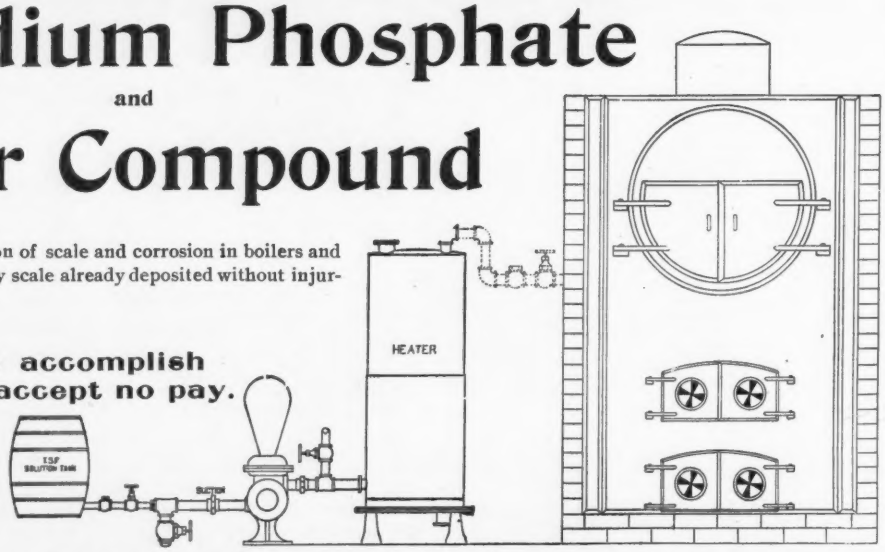


Illustration of method for a continuous feed of Tri-Sodium Phosphate, by introducing the solution into suction of boiler feed pump; the check valve shown is to be used in the case of water pressure in suction pipe; the globe valve regulates the flow from vessel.

THE KEYSTONE CHEMICAL MFG. CO. CAMDEN, N. J.

CHICAGO OFFICE
1601 Great Northern Building

A Fair Proposition

WE know beyond question that our method of preparing Chemicals specially for each feed-water is the proper one; therefore we are so persistent in asking engineers to send us samples of scale for analysis.

If you have any scale in your boilers and would like to know what it consists of, kindly answer the questions below and send us a small sample, enclosed in this sheet. There is no charge for the analysis.

How many boilers have you?.....

State capacity of each boiler.....

How often do you clean boilers?.....

Do you blow out or wash out all sediment each time?.....

How often do you open the blow-off while at work?.....

How long do you keep it open?.....

Name the river or source of your water supply.....

Does the feed-pipe clog up or form scale?.....

Do you use a heater?.....

Do you run day and night?.....

If sample of scale is sent in separate package, please mark same with your name and address.

Your name.....

Address.....

Firm name.....

Mail this to

GEO. W. LORD

2238-50 N. 9th St., Philadelphia, Pa.

SOLE MANUFACTURER, LORD'S BOILER COMPOUNDS

HOUGHTON'S MONTHLY LETTER TO ENGINEERS

DEAR MR. ENGINEER:

Brother Rice said it would improve the PRACTICAL ENGINEER to take the ads. off of the front page. If it improves the paper, it helps the advertiser, so here we are on the inside.

We are going to write you a monthly letter. Going to try to obtain your confidence. It is only your confidence that is necessary for us to obtain, as your trade will follow as a natural consequence.

If you are not buying our Cylinder Oil; if you are not using the MARCK STEAM TRAP; if you are not using the VIX Rubber Goods and Packing, it is because you have more confidence in the goods which you are using than you have in ours.

Now, we have had an experience of 32 years in obtaining the confidence of engineers and practical men. We have succeeded fairly well. We would succeed better could we get the information to them more frequently.

For instance, our men call regularly at the office; see the office man; give him facts; and these facts win the office man's confidence and he places the order for our goods, whether it be traps, oil or packing. But, when the goods are sent in to you for trial, you have not heard a thing about what has been said to the office man, you naturally think your practical knowledge is worth more than the office man's theory and perhaps you have been sent in so many inferior and impractical articles that you have not the greatest confidence in the judgment of the office man.

Now, when our goods come into you, please remember that every article sold by us is covered by the HOUGHTON guarantee. That means it can be returned and money refunded if not satisfactory. This permits you to recommend our goods to your office people with safety and with the full knowledge that even failure on the part of the goods to be adapted to the work for which you desire them will not embarass you, even though the error in judgment may be your own. For if they do not give satisfaction they can be returned and that is all there is to it.

Don't you think that a concern that stands back of the engineer in this fashion is deserving of the engineer's support? Is it not a good thing for engineers in general to show the commercial world that they are going to demand this kind of treatment. Let our competitors see that you are giving us trade on account of this policy. How long will it be before they follow us?

E. F. HOUGHTON & CO.

240-250 W. Somerset Street, PHILADELPHIA 175-177 Lake Street, CHICAGO

Do You Know

that NONPAREIL CORK is the best by every test?

IT IS

The most enduring, no strain on pipes, it is the lightest covering made. In radiation tests it stands higher than any other pipe covering in the world.

It is not affected by heat, cold or moisture.

Good for Steam, Water, or Brine Pipes, Cold Storage Insulation.

IT IS EASILY APPLIED

The price is always right, and your covering is always tight

Better let us talk it over with you

We also manufacture

Nonpareil Cork Flooring and Tiling

which deadens sound, and for neatness and durability, has no equal

John R. Livezey

120 So. 20th Street

PHILADELPHIA

NONPAREIL CORK MFG. CO.

GERKEN BUILDING

Chambers St. and W. Broadway

New York

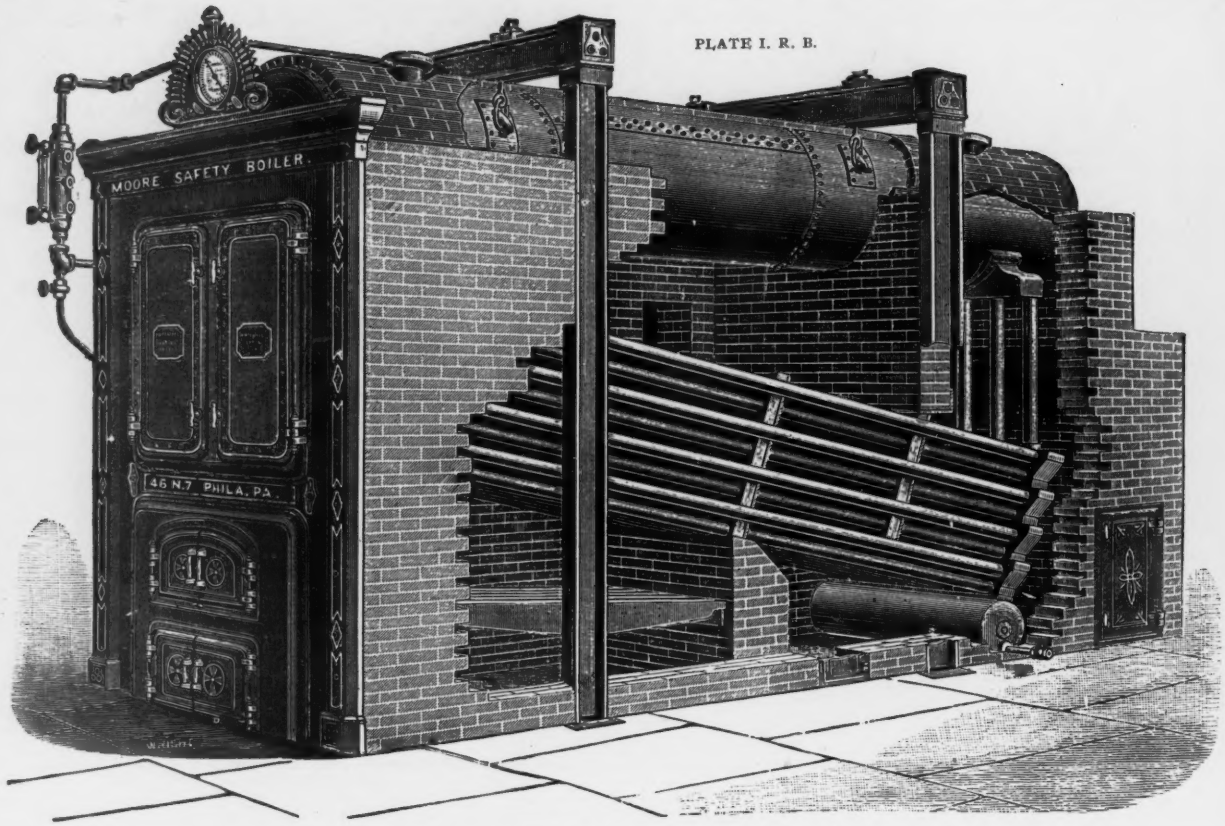


PLATE I. R. B.

MOORE'S HIGH PRESSURE SAFETY STEAM BOILERS, PHILADELPHIA. 800,000 H. P. in use, both in Europe and America

Repairs of Water Tubes. Boilers of all types a specialty. We have special tools for this purpose. TELEPHONE 1-55-82-A
We keep constantly on hand ready for shipment 1000 horse-power. There can be no delay. **Send for Catalogue.**

ESTABLISHED 1864 PHONE

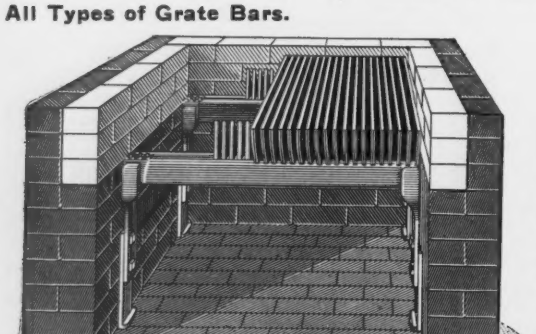
E. J. Moore Machine & Foundry Co.

MACHINISTS, FOUNDERS & PATTERN MAKERS

Gray-White, Semi-Steel Aluminum Alloy Castings. Mills and Pulverizers for Minerals, Cereals, &c.
Stamping and Embossing Presses, Roller Mills.

2227-2235 WOOD STREET

All Types of Grate Bars. **PHILADELPHIA, PA., U. S. A.**



The Longest-lived Grate Bar That Ever Lived.
Call Your Engineer's Attention To This Bar

IMPROVED AMERICAN GRATE BARS

PATENTED.
THE ONLY GRATE WITH ADJUSTABLE FRAME.
THE ONLY GRATE WITH LOOSE TEETH BETWEEN THE BARS.

We wish to call your attention to a few important points in our new Furnace Grates.

The adjustable supporting frame, not coming in contact with the brick-work, saves the walls from getting loose, and can be adjusted to any height desired. The perforated supporting cross bar has less obstruction to a free circulation of air than any other Cross Bar made. The movable teeth between the Grate bars can easily be changed at any time, so as to give an air space between the bars that is desired to accommodate any size of fuel; the Movable Teeth also give the bars more freedom to expand and contract, thereby the bars are less liable to warp.

The American Grate Bars have given satisfaction where others have failed. Are made and for sale only by us; other parties have no right to make or sell them. **Send for circular and references.**

E. J. MOORE MACHINE and FOUNDRY CO.,
SOLE MANUFACTURERS,
Delivered F. O. B. PHILADELPHIA, U. S. A.

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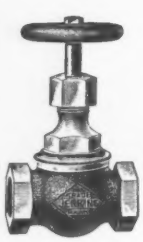

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